WALLOWA-WHITMAN NATIONAL FOREST

FISHERIES HABITAT IMPROVEMENT

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GRANDE RONDE RIVER SUBBASIN

UPPER NORTH FORK JOHN DAY RIVER SUBBASIN

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INTRODUCTION

This report describes fisheries habitat improvement accomplishments on the Wallowa-Whitman National Forest (NF) during FY 1989 (April 1, 1989 - March 31, 1990). This multi-year, multi-phase fish habitat improvement effort which began in 1984, is funded under the amended (1987) Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program, Measure 703(c)(l), Action Item 4.2. Principal program funding is being provided by the Bonneville Power Administration (BPA).

The overall Forest fisheries program goal is to optimize anadromous spawning and rearing habitat conditions for juvenile and adult chinook salmon and steelhead trout, thereby maximizing smolt production as a mitigation measure for fishery losses due to the mainstem Columbia River hydroelectric system. Specific goals and objectives of this fisheries habitat improvement program are detailed in the Wallowa-Whitman National Forest Habitat Improvement Plan (Uberuaga 1988).

Project activities are located on four Ranger Districts (RD) within the Wallowa-Whitman National Forest. The Baker and Unity RD administer the upper headwater portions of the North Fork of the John Day River. The Umatilla National Forest (NF) administers the remaining downstream sections on NF lands. The La Grande, Wallowa Valley, and Eagle Cap RD's and Hells Canyon NRA administer streams on NF lands within the Grande Ronde River subbasin; the La Grande RD being responsible for the Upper Grande Ronde and the other units the Lower Grande Ronde and tributaries.

PROJECT SUBBASIN DESCRIPTIONS

The Grande Ronde River subbasin is comprised of a drainage area of approximately 4,070 square miles which includes such major streams as Joseph Creek, Catherine Creek, the Upper Grande Ronde, Wenaha, Wallowa, Lostine, and Minam Rivers, as well as a few smaller tributaries (Oregon Department of Fish and Wildlife 1986). The Upper Grande Ronde Drainage, approximately 1,622 square miles, is located above the confluence of the Grande Ronde and Wallowa Rivers. There are currently four ongoing improvement projects on NF lands within this basin (Figure 1). The Joseph Creek drainage, a major drainage within the Lower Grande Ronde River, drains approximately 556 square miles and contains four major ongoing projects (Figure 2)., While these upstream areas are all on NF lands, those lands below the headwaters lie primarily in private ownership. Streamflow patterns in the Grande Ronde exhibit typical spring floods common to northeast Oregon streams with minimum flows usually occurring in August or September.

The North Fork of the John Day River originates on the northeast slopes of Columbia Hill, a peak of the Elkhorn Mountain Range within the North Fork John Day Wilderness. After three miles, the stream leaves wilderness at Peavy Cabin, a local landmark, and reenters the wilderness near the North Fork John Day Campground, approximately seven miles of non-wilderness stream. The North Fork of the John Day River is under consideration for addition to the National Wild and Scenic Rivers System. The river and its tributaries provide over 40 stream miles of salmon and steelhead habitat.

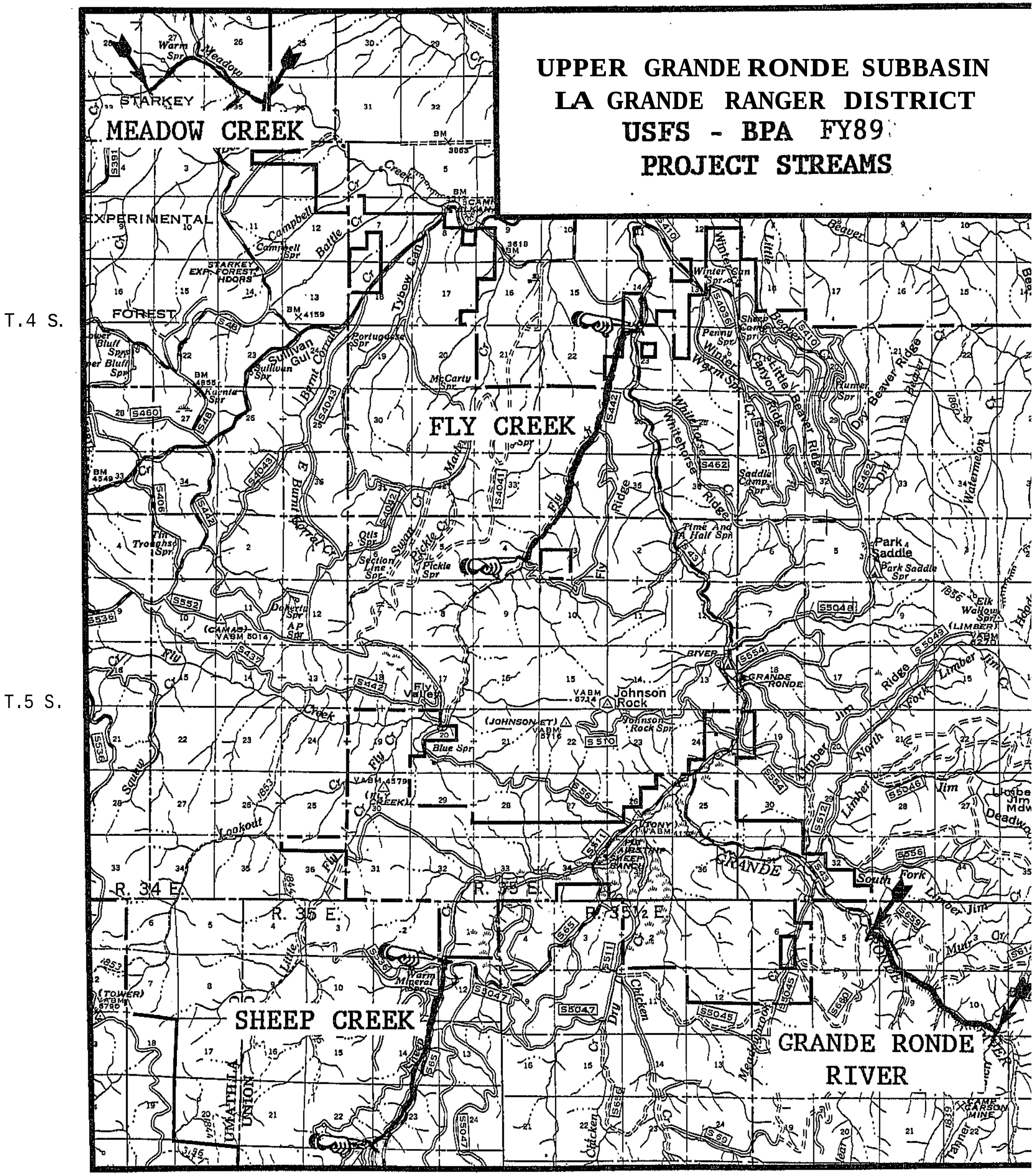
Anadromous fish contend with the lower three Columbia River dams with regard to upstream and downstream passage. Figure 3 identifies several John Day subbasin fisheries improvement projects on NF lands. Additional projects may be planned following additional study during FY 90.

FISHERIES RESOURCES

The Grande Ronde River subbasin supports both natural and hatchery runs of spring chinook salmon and steelhead trout. Natural rainbow trout are also produced along with a remnant coho salmon run. Chinook salmon juveniles which are used for supplementation of natural stocks are currently being produced at Looking Glass Hatchery. A new chinook and steelhead adult trapping and juvenile outplanting facility was recently constructed (1987) at the confluence of Deer Greek (Big Canyon) and the Wallowa River. The Joseph Creek subbasin is strictly managed for wild steelhead production. Current steelhead production potential for the Grande Ronde Basin is estimated at 16,566 adults and 432,844 smolts (Oregon Department of Fish and Wildlife 1986). However, actual production is estimated to be near 10-20 percent of potential due to mainstem passage problems for juveniles and adults.

The John Day River subbasin supports the largest remaining, exclusively wild runs of spring chinook and summer steelhead in Northeast Oregon, the North Fork of the John Day River being the most important anadromous producer in the subbasin.

FIGURE 1


UPPER GRANDE RONDE SUBBASIN
LA GRANDE RANGER DISTRICT
USFS - BPA FY89
PROJECT STREAMS
MEADOW CREEK
FLY CREEK
SHEEP CREEK
GRANDE RONDE RIVER
T.4 S.
T.5 S.
R. 34 E.
R. 35 E.
UMATILLA
UNION

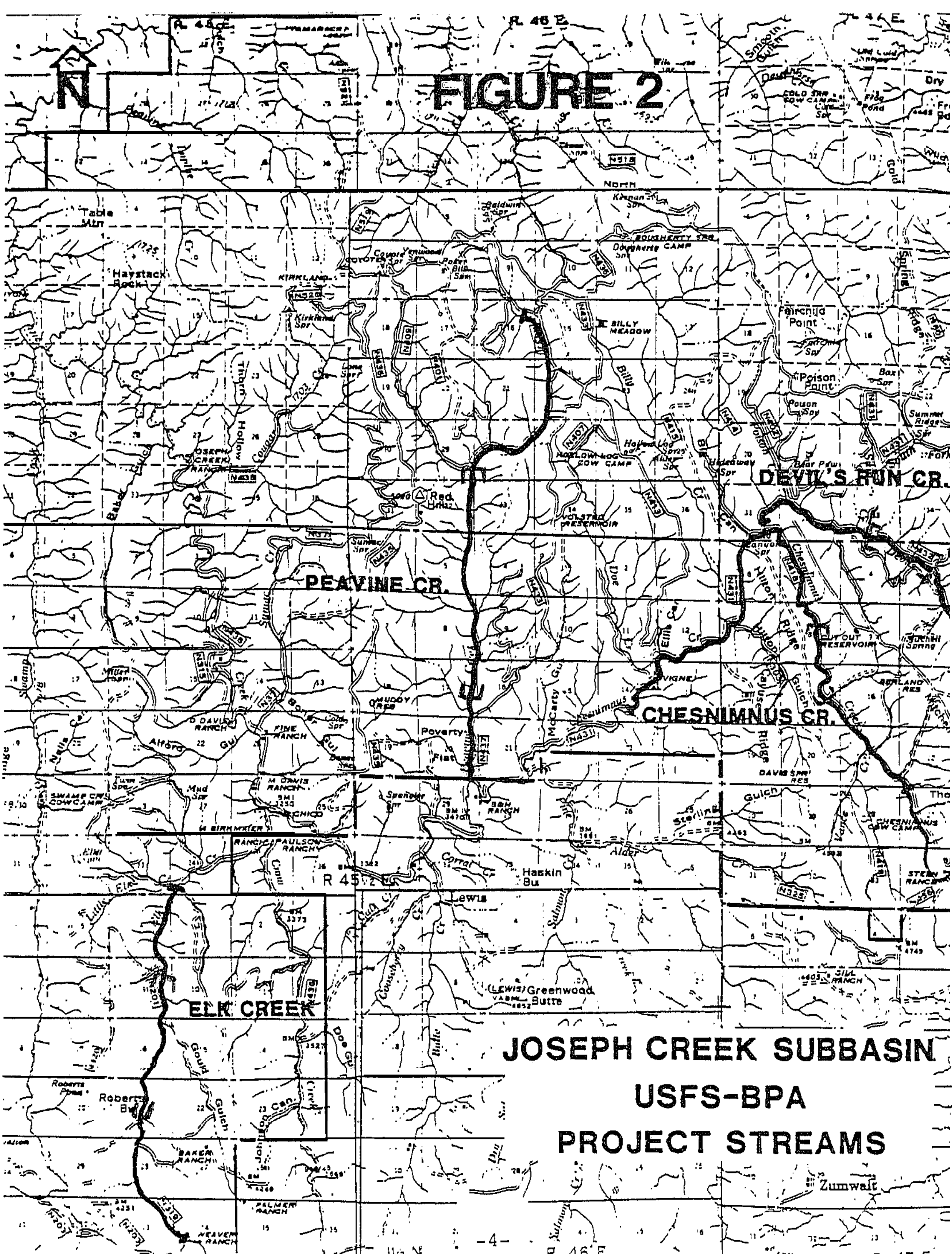
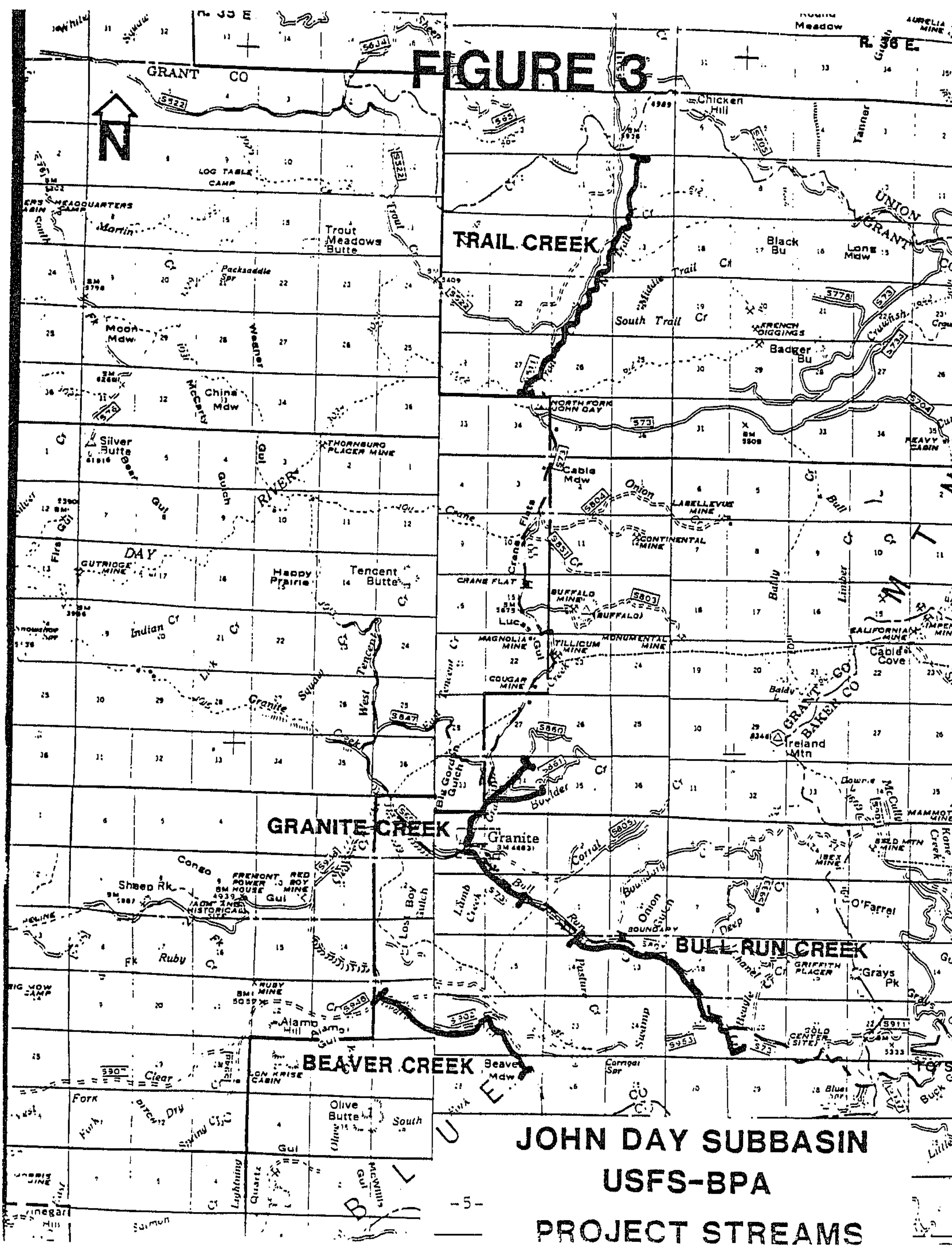


FIGURE 2
JOSEPH CREEK SUBBASIN
USFS-BPA
PROJECT STREAMS
DEVIL'S RUN CR.
PEAVINE CR.
CHESNIMNUS CR.
ELK CREEK
N
R. 46 E.
R 45 1/2 E.
Table Mtn
Haystack Rock
Fairchild Point
Poison Point
Red Hill
Poverty Flat
Haskin Bu
Lewis
Greenwood Butte
Roberts Bu
Zumwalt
BILLY MEADOW
JOSEPH CREEK RANCH
FINE RANCH
BAKER RANCH
PALMER RANCH
HEAVER RANCH
CUT OUT RESERVOIR
CHESNIMNUS COW CAMP
HOLLOW LOG COW CAMP
DOUGHERTY CAMP
SWAMP CR COW CAMP

FIGURE 3



JOHN DAY SUBBASIN
USFS-BPA
PROJECT STREAMS

LIMITING FACTORS

Historic patterns of land use in northeast Oregon have left most riparian areas in a far less productive state than their natural potential. Placer mining in the late 1800's left many streams with little or no shade, large sediment loads, and radically disturbed channels. Inadequate control of past activities such as logging, roading, and grazing left managers with degraded habitats in most cases. Farming and irrigation of cropland in the lower portions of the basins has also significantly added to habitat loss. Symptomatic of these conditions are wide, shallow streams with low summer flows and high water temperatures, channels with low diversity, and typically without adequate amounts of instream debris.

Limiting factors associated with instream and riparian habitat degradation were identified by the Oregon Department of Fish and Wildlife, USDA-FS, and Confederated Tribes of the ` Reservation (James 1984). These factors are.:

1. High summer water temperature - Loss of riparian vegetation and low summer flows result in water temperatures in excess of 80 degrees fahrenheit. High temperatures limit available summer smolt rearing habitat and make the cooler upstream tributaries relatively more important to salmonid production.

2. Low summer flows - Irrigation withdrawals result in extremely low flows in the Grande Ronde River. Poor watershed management practices further aggravate flow conditions, resulting in many intermittent streams which were once perennial.

3. Lack of riparian vegetation - Riparian vegetation loss, principally from ungulate overgrazing, results in many undesirable conditions. Essential fish habitat is lost along with the riparian area's ability to dampen flood peaks and increase groundwater recharge. Channels become unstable and readily erode, concentrating flows and accelerating downcutting.

4. Lack of habitat diversity - Low habitat diversity, is caused principally from the absence of large, woody debris in and along stream channels. Wood plays a critical role in maintaining stream structure and fisheries production. Past activities such as instream debris cleaning programs, have left many streams without this critical component.

5. Lack of Channel Stability - Low channel stability results from many causes : overgrazing, improper timber harvest methods, instream timber salvage, mining operations, etc. Streams, once narrow and deep, widen out and become shallower, becoming more prone to creating new channels and down cutting.

METHODS AND MATERIALS

FY 89 FS fisheries improvement implementation projects were performed by FS fish, wildlife, and range personnel using service type contracts for equipment use and project construction.

Riparian Vegetation Restoration

Fencing - Fencing to control ungulate use along riparian zones is a primary management approach used to protect and rehabilitate habitats. Two commonly used methods are riparian pasture fencing and riparian exclosure fencing. Pasture fencing usually encloses a wide section of riparian zone, allowing for future carefully controlled grazing. Riparian exclosure fencing results in permanent, narrow exclosures along riparian zones with no future grazing. Several streamside management unit fencing techniques are considered, i.e., conventional barbed-wire, smooth-wire New Zealand, and buck and pole.

Streamside Plantings - Streamside vegetation plantings were integrated with other rehabilitation measures to provide riparian shade and cover. This is needed to reduce water temperatures, stabilize streambanks, and supplement the release of existing natural vegetation. To ensure success and provide protection of this investment, supplemental plantings usually occurred within fenced riparian pastures or exclosures. Species most commonly planted were willow, cottonwood, alder, dogwood, and hawthorne. Plantings are made from small scions (12-16"), larger pole cuttings (3-6'), potted nursery stock from seedlings, and rooted stock from cuttings. Planting is done either by hand, auger or backhoe depending on site conditions. Planting procedures usually include scalping, excavation to the water table, mulching and fertilization.

Habitat Diversity Improvement

Adding habitat diversity to a stream channel may occur in many ways and usually results in an improvement of pool area, pool quality, spawning gravel and cover, all parameters characteristic of good habitat. The types of instream structure used include: log weirs/berms in a variety of configurations: whole tree additions with and without rootwads; rock sills/ berms; rock clusters and deflectors, riprap. Both "hard" structures such as rock and log sills or weirs and "soft" structures such as whole tree additions or boulder placement were constructed. First, the sources of large woody material were identified and individual trees marked for felling. When abundant and not contributing to stream shading, trees were taken from within or near riparian zones. Soft structure additions were added at various angles, usually parallel to shore in order to maximize edge habitat. When possible, leaning trees next to the stream with attached rootwads were pushed over by the backhoe. Whole trees were cabled to their stumps or nearby debris with 3/8" galvanized cable; cabled and revetted into banks; cabled and deadmanned into banks: anchored by piling large boulders on top of the tree trunk; and left uncabled when approximately two-thirds of the tree length was above high water.

Planning, Inventorying, and Monitoring

Planning, inventory, and monitoring activities ware conducted on NF lands in FY 89 in addition to habitat restoration. Each of these activities are ongoing in nature and continue to be refined.

RESULTS

Fisheries habitat improvement accomplishments during Fiscal Year 1989 occurred in four major work activities:

(1) Project monitoring, evaluation and reporting.
(2) Maintenance of previous projects.
(3) Streamside vegetation plantings.
(4) Implementation of habitat rehabilitation projects

Complimentary to these accomplishments, the Lagrande and Baker Ranger Districts recruited and filled a full-time fisheries biologist position in June of 1989.

Project Iplementation Note · Upper Grande Ronde Sub-basin

Due to the extreme fire season during July through September much of the LaGrande Ranger District's fish biologist and technician support time that was originally scheduled for BPA implementation work was directed to emergency fire fighting efforts. Construction starts planned for Meadow Cr. fence, and UGRR structures were deferred until the 1990 season. Most preparatory work leading up to actual construction for each project was, however, completed. A major fire rehabilitation effort was initiated in October by our fisheries crew on the Tanner Gulch burn area which encompassed 4500 acres of the Upper Grande Ronde sub-basin immediately above the UGRR project area (Appendix III). Significant fish biologist time has also been spent providing input for planned salvage timber sales and additional recovery efforts.

Habitat Rehabilitation Project Implementation

Implementation activities occurred on 9 active FS projects during FY 89. Hard structure habitat rehabilitation activities are now complete on 5 of those 9 projects: Sheep, Elk, Fly, Devil's Run, and Peavine Creeks.

The following discussion presents the current status of each active project along with N 89 accomplishments.

Prciect I · Meadow Creek

Meadow Creek, a major subbasin of the Upper Grande Rcnde River, lies within the Starkey Experimental Forest boundary. Meadow Creek and its riparian zone have a long history of impacts dating back to early logging activities. Grazing has further impacted the riparian community. Salmonid populations in Meadow Creek are composed of anadromous summer steelhead trout and resident rainbow trout. Historic Umatilla Indian tribal records document chinook salmon production in this stream. An extensive biological data base exists from aquatic research conducted since 1977. Maps of the project area are found in Appendix I.

The Meadow Creek project is a jointly funded BPA-FS improvement and evaluation project. The FS is responsible for funding all pre and post project improvement evaluations while BPA funds the planned implementation activities. The Pacific Northwest Research Station conducted both spring and fall cutmigrant smolt sampling during N 87. Their personnel also conducted an analysis of large woody debris, comparing current conditions to those of a historical U.S. Fish and Wildlife Service inventory. During N 87, the FS also contracted with Washington State University to conduct a complete hydrological analysis of the Meadow Creek drainage, including design and location of proposal improvement structures. A preliminary research design was prepared by PNW in 1988 which identifies evaluation objectives and design for 22,400 feet of stream. This preliminary design for structure modifications was interfaced with the long term research design (Appendix 3). In total, eight cut of eleven Habitat Improvement Units (HIU) will receive either full'cr partial treatment. A variety of integrated treatments were prescribed on four miles of stream that included one mile of game-proof fence, planting of deciduous stock, adding boulders for a variety of rock structures, and constructing log type structures. Additional detail on specific habitat improvement measures at different locations including structure objectives and construction design evaluations for each HIU are available upon request.

The N 89 task accomplishment for Meadow Creek consisted of redesign and layout of the access road. The road reconstruction will be very low standard, requiring one drainage structure and minimum clearing. A rock pit site was located near the middle of the project that will serve needs for the upper reach during N 90 construction activities. This redesign will provide a significant cost savings. District engineers will use an equipment rental agreement and also drill and blast the rock source this summer.

The fence installation contract is expected to be let in June, Supplies and materials are beginning to be ordered. A final review of the project design with various agencys and individuals is scheduled for May.

Low elevation infrared photos of the project area were purchased with Forest Service funds for use in field layout and monitoring.

Project II · Upper Grande Ronde River

The Upper Grande Ronde River (RM 194-212) drains en area of approximately 69 square miles. A N 85 habitat inventory of the upper reaches identified approximately three miles of poor quality salmon and steelhead spawning/rearing habitat, due primarily to past mining activities. A hydrological engineering evaluation in June 1987 provided the final design for structure placement. Specific project objectives were: (1) adult holding pool construction, (2) spawning gravel retention, and (3) increase juvenile habitat diversity.

Implementation work commenced in N 87 on one mile of stream. Approximately one mile of additional mainstem stream was improved during N 88 with a total addition of over 230 soft structures, and construction of 90 large pools. Specific details describing type and location of structures can be found in the N 87 and N 88 annual reports. Construction work has been confined to a narrow time frame between July and September due to the timing of spring chinook spawning activity. Construction has been accomplished with a personal services rental contract for a Model 201-C Hydra excavator with operator, a 580-C Case tractor and dump truck. Additional boulders and logs were stockpiled in N 88 for initiating construction on the last mile of stream.

Instream structure work and bend repairs scheduled for N 89 was deferred to 1990 and 1991. Preparatory supplies and materials needed for the next mile of construction are stockpiled at the district. A preliminary design for interpretive signing of the project was developed and after coordination with the landscape architect, will be implemented in N 90.

Project III · Fly Creek

Fly Creek, a significant tributary to the Upper Grande Ronde at river mile 184, has a drainage area of 52 square miles and a stream length of about 16 miles. The stream is characterized by two general reaches. The upper 8-mile reach of stream (Fly and Little Fly) lies on private land and is a low gradient, meandering meadow-dominated reach that has been impacted by livestock grazing.

The lower 7-mile reach lies on NF lands and is a low-moderate gradient stream oorsing the first mile through a meadow bottom into a narrow valley. A 1985 habitat inventory identified a pool/riffle ratio of .2/.8 with low quality pools and little instream structure. Previous impacts include livestock grazing, roading and logging. Habitat objectives included increasing pool quality and quantity, diversifying instream habitat for rearing steelhead trout and increasing streambank stability.

Approximately 250 instream structure additions occurred in FY 87, consisting of 56 hard structures (log weirs) and 194 soft structures (whole tree additions). Instream structure additions continued during N 88 resulting in a total of 354 whole tree additions, 80 weirs, 5 boulder groups and 3 side channel excavations over the 7 mile reach. All structures were placed with a personal services rental contract for a backhoe and operator during June through September,

Considerable effort was also spent during FY 88 to close the Fly Creek road and its five stream crossings. Physical barriers were excavated at the top of the project above the first stream crossing and downstream at the Forest boundary. The closure was subsequently reinforced in N 89 by district road maintenance crews to include ripping, seeding and cross drains.

The fence location has been coordinated with the grazing permittee and a one mile meadow dominated reach was laid out in FY 89 to include watering and crossing sites for sheep, Contract specifications for New Zealand smooth wire fence are being adjusted for a sheep type exclosure. The contract will be let by June and administered by the district's range conservationist. A preliminary design for interpretive signing of the project was developed and after coordination with the landscape architect, will be implemented in N 90.

Project IV · Sheep Creek

Sheep Creek is tributary to the Grande Ronde River at RM 197. The drainage area comprises approximately 58 square miles. Eleven miles of stream contain spawning and rearing habitat for chinook salmon. The upper two miles of stream lie on NF land and is characterized by a moderate gradient, narrow valley floor, which is heavily timbered. The middle three miles are characterized by a low gradient, meadow/timber complex with a high degree of meander. The remaining six miles of stream are low gradient, meadow dominant, and lie on private land. Watershed uses and impacts include roading, logging, livestock grazing, and loss of lodgepole pine stands from insect epidemics.

Sheep Creek has received aquatic habitat improvements over a number of years. In 1980, a riparian pasture fence was constructed along one mile of stream, followed by the addition of 101 structures in 1985, creating 10,489 and 3,228 square feet of pool and cover areas, respectively.

In N 86, riparian pasture fencing was constructed along an additional 1.6 miles of stream.

A June 1987 habitat improvement project evaluation contract with hydrologist John Osborne, Washington State University, recommended digger log modifications and additional large woody debris placements along Sheep Creek. Twenty-seven structures were modified during N 87.

Task accomplishment for 1988 included normal fence maintenance, photo point evaluation of structure effectiveness and planting of 3,000 3 year old Englemann spruce trees, 2,000 deciduous cuttings and 3,000 deciduous nursery stock. Deciduous stock was comprised of native alder, hawthorns, willow, red-osier dogwood and black cottonwood. First year estimates of survival appear to be 80% for the spruce and 50% for the deciduous stock.

During N 89 additional modification was done on the remaining digger logs. An additional 300 rooted deciduous stock (hawthorne and alder) were spot planted along 1500 ft. of stream. Second year estimates of survival appear to be leveling at 60% for spruce and 40% for the deciduous stock. Intensive stocking surveys are scheduled for N 90. A preliminary design for interpretive signing of the project was developed and after coordination with the landscape architect, will be implemented in N 90.

Project V - LaGrande District Administration, Monitoring, and Reporting.

Administration

Administrative activities included (1) review and comment on subbasin planning activity, (2) update and preparation of 1990 - 1995 implementation plan needs with projected budgets for active and new projects, (3) coordinating NEPA document changes and acquiring required permits, (4) presentation of the Meadow Creek project to the Monitoring and Evaluation Group, (5) coordination and evaluation of objectives for the Meadow Creek project design with PNW scientists, (6) field coordination of fence design and layout with permittees, (7) coordinating/modifying specifications for elk and sheep exclosures fences for Meadow Creek and Fly Creek, (7) coordination with engineers for access road and rock pit development and (8) contract preparation,

Monitoring

Monitoring activities consisted of reading permanent photopoints on Sheep Creek, structure effectiveness evaluation with random photo monitoring on Fly Creek and Upper Grande Ronde River and sediment embeddedness sampling on the Upper Grande Ronde River. Photo albums, structure evaluation documents and embeddedness data are available at the district upon request.

A basin wide stream monitoring plan was developed for the district that is complimentary to ongoing BPA project monitoring activities (Appendix II). Forest Service funds were used to implement this project. The overall goal of this plan is to provide baseline data on water quality in the major watershed subbasins of the Upper Grande Ronde River. Macroinvertebrate bioassessment will be used to help determine which streams could be most cost-effectively managed or improved for fisheries, and to identify point and non-point sources of pollution that might impair fish production.

Inventory

Approximately thirty one miles of stream was inventoried during FY89 by the district's fisheries biologist and technicians. This project was funded by the Forest Service and incorporated technical training for forest survey crews. This effort is complimentary to the 1991 - 1995 Forest/BPA Implementation Plan., Physical and biological inventories used the Hankin and Reeves limiting factors analysis procedures. Methods and results of the survey are available upon request.

Project VI - LaGrande District Maintenance

Maintenance

The following table displays the types and amounts of maintenance activities conducted on an annual basis.

STREAM NAME	FENCING		INSTREAM STRUCTURES			PLANTING		
	TYPE	LENGTH	MILES	TYPE	NUMBER	STOCK	QUANTITY	LENGTH
SHEEP CR.	BARBED	1.0 MI.	3.0	HARD/SOFT	101/25	DECID	300	1500FT
FLY CR.			6.0	HARD/SOFT	112/388			
U.G.R R.			2.0	HARD/SOFT	95/230			

The effectiveness of each structure in achieving project goals was monitored and evaluated for the three listed streams. Although spring flows were high (25 year hydrologic event), only hand maintenance was required on each of these streams, usually consisting of rip-rap reinforcement of weir key ends and adjustment of soft structure configuration.

The livestock exclosure on Sheep Creek required repair prior to livestock turn-on consisting of clearing fallen trees. Periodic follow-up was required on several occasions to mend and tighten wire. Livestock did not enter the exclosure during the grazing season.

Deciduous and conifer plantings were fertilized using two-year Ortho-N tabs. Fiberglass matting and shade cards were selectively placed on surviving conifers to reduce sun scald and competition from sod forming grasses, Spot planting of 300 rooted deciduous stock was conducted on areas where the first year planting mortality and big game damage was greatest. A deer repellent, consisting of a rotten egg extract as well as plastic ribbon, was applied to deciduous stock located along known game trails to reduce damage. Minor pruning of selected deciduous stock was done to increase root growth. Much of this maintenance effort, including dry season watering of planted stock, was funded and conducted by the Forest Service Youth Conservation Corp. (YCC) personnel.

Project VII · Chesnimnus Creek

Chesnimnus Creek is tributary to Joseph Creek at the confluence with Crow Creek. The drainage area is approximately 190 square miles; about 108 square miles are on NF land. There are 12 miles of Chesnimnus Creek on NF land and about 8 miles on private land that require improvement. Chesnimnus Creek is characterized by low gradient, with short stretches of moderate gradient in the middle reaches. Narrow bluegrass meadows dominate the upper reaches, with scattered lodgepole pine overstory. The middle reaches are rocky, narrow ravines which open into broader U-shaped canyon bottoms of logged-over mixed conifer stands. The private land area is dominated by wider canyon bottoms consisting predominately of hay fields and pastures.

Watershed uses and impacts include roading, logging, livestock grazing, and farming. Numerous reaches on both NF and private ground have been channelized to accommodate road construction and hay field development. Intensive habitat improvement work has been implemented concurrently on both private and public lands for the past several years. Program measures on NF lands to date include instream structure addition, riparian pasture fencing, and vegetation plantings.

During FY 87, the Wallowa Valley RD constructed riparian pasture fencing along 4.63 miles (243 acres) of Chesnimnus Creek, Twenty-five instream structures (weirs) were also constructed.

FY 88 accomplishments include streamside vegetation plantings in Sections A, B, and F. Plantings involved site preparation, planting, fertilizing, watering, pruning, and protection (game repellent and tree wrappings). The following presents specific planting data for each section (see Figure 4 for Chesnimnus Creek stream sections).

N 89 habitat improvement measures concentrated on Section E. Accomplishments include construction of 3.0 miles of fencing (4-strand barbed wire) designed as 2 exclosures, exclosing 1.35 miles of stream course. Construction of 104 instream habitat improvement structures, consisting of boulders, whole trees, and logs, or combinations of these. A major emphasis was placed on "soft" structures. The objective of structure design was to imitate naturally occurring large organic matter (LOM) and reproduce these hydraulic processes. (see Appendix I for locator map, and Appendices V-VII for Explanation and Summary sheets),

Equipment Used:

Backhoe · Case 580C	84.0 hrs at $32.50/hr =	$2,730.00
Loader · Cat 931	85.5 hrs at $32.50/hr -	$2,778.75
Truck/Trailer	9.0 hrs at $32,50/hr -	$ 292.50
Dumpbox Trailer	23.5 hrs at $32.50/hr =	$ 763.75
		$6,565.00

Forty-six (46) permanent photo points were established on 4.5 miles of stream course covering habitat improvement measures conducted in FY 88, within Sections A and B.

Project VIII · Elk Creek

Elk Creek, a significant tributary to Joseph Creek, has a drainage of about 25 square miles, of which 16 square, miles are NF lands. Approximately 12 miles of spawning and rearing stream occur within the drainage.

The stream's headwater lies within private farm, timber, and grazing lands. Sediment contributions from these uplands contribute to the current degraded condition in Elk Creek. Activities affecting water quality and streamflows include past and current logging, road construction, grazing, and farming.

Two small, riparian pasture fences were constructed along Elk Creek in 1976. By 1978 about 40 instream structures had been added. Between 1978 and 1987, the stream received about five miles of pasture fencing, another 40 instream structures, and an intensive planting of deciduous vegetation. Nine additional instream structures (log weirs) were added to Elk Creek during N 87.

FY88 accomplishments include placement of instream structures (16 log weirs, 7 tree tops, and 50 boulders) and vegetation plantings.

N 89 accomplishments included establishing sixteen (16) permanent photo points on stream course covering habitat improvement measures conducted N 88. (see appendix I for project locator map).

Project IX - Devil's Run Creek

Devil's Run Creek is a small tributary to Chesnimnus Creek. This stream, inventoried in September 1986, has been heavily impacted by timber blowdown, logging, fire, and grazing. The lower three miles of stream exhibit little instream cover and low structural diversity. Juvenile young-of-the-year salmonids are abundant, but overwintering habitat is poor. N 87 activities were limited to the tentative location of riparian pasture fencing along two miles of stream and preparation of a detailed budget for N 88 design activities.

N 89 accomplishments include construction of 4.0 miles of fencing (4-strand barbed wire) exclosing 2.0 miles of stream course. Construction of 125 instream habitat improvement structures, consisting of boulders, whole trees, and logs, or combinations of these. A major emphasis was placed on "soft" structures The objective of structure design was to imitate naturally occurring'large organic matter (LOM) and reproduce these hydraulic processes, (see Appendix I for locator map, and Appendices V-VII for Explanation and Summary sheets).

Equipment Used:

Backhoe - Case 580C	86.0 hrs at $32.50/hr =	$2,795.00
Loader - Cat 931	81.0 hrs at $32.50/hr -	$2,632.50
Truck/Trailer	9.0 hrs at $32.50/hr =	$ 227.50
Dumpbox Trailer	23.5 hrs at $32.50/hr =	$390.00
		$6,045.00

Project X · Peavine Creek

Peavine Creek, a tributary to Chesnimnus Creek, has a drainage area of approximately 26 square miles. Peavine Creek's stream channel has received extensive alteration, primarily from road building and logging. Three small riparian exclosures ware constructed near the mouth of Peavine Creek in 1970. These exclosures dramatically show the effectiveness of riparian exclosure fencing and received plantings of cuttings and rooted, deciduous stock in 1975. In 1984, using BPA funding, the stream received 51 instream structures and 3.25 miles of riparian pasture fencing.

FY 87 activities along Peavine Creek consisted of repowering the solar-electric fence to prevent ungulate grazing within the riparian zone.

FY 88 improvements along Peavine Creek consisted of vegetation plantings within exclosures #4 and #5:

The only scheduled work for FY 89 was maintenance of existing project work. (see Project XIII for results, and Appendix I for project locator map).

Project XI · Riparian Vegetation Plantings

Vegetation plantings in riparian areas, used in conjunction with other rehabilitation measures, prove effective in providing riparian shade and cover, two essential components of good fish habitat. Extensive plantings have occurred in the Lower Grande Ronde subbasin, beginning in 1975 with Peavine Creek. More planting occurred in 1983 and 1984 on Peavine and Elk Creeks, and during FY 87 these two streams and Chesnimnus Creek received intensive spot plantings. Chesnimnus Creek received 6,685 plantings, Elk Creek 1,920, and Peavine Creek 600. No plantings occurred in the Upper Grande Ronde subbasin in N 87, although a procurement contract for the FY 88 delivery of 4,000 rooted stock of mixed species was awarded to the Tree of Life Nursery. These rooted stock were planted by contract along with approximately 2,000 willow poles in early FY 88.

The success rate of streamside plantings has been highly variable. Elk and Peavine Creek planting survival is estimated at 80 percent while Sheep and Chesnimnus Creeks are lower, from 20-50 percent. A non-BPA project, Swamp Creek, has a near 100 percent survival of plantings. The success of streamside plantings is highly correlated several factors, i.e., site selection, handling care, planting method, and species. Both spring and fall plantings are successful, if proper care is taken. To ensure this, future plantings occur by contract through established nurseries.

During FY 89 no BPA funded Riparian planting occurred on the Wallowa Valley Ranger District.

Appendix VIII contains before and after photographs showing the results of the riparian planting program.

Project XII - Monitoring, Evaluation, and Reporting - Wallowa Valley RD

Monitoring and Evaluation to quantify the effectiveness of habitat improvements on the Wallowa Valley Ranger District continued in FY 89. Monthly and Annual Reporting continues as outlined by BPA.

I. Stream Water Temperature

Monthly maximum stream water temperature records during 1980-1986 for Devil's Run, Elk Creek, and Peavine Creek were compiled (Data collection was financed with other than BPA funds to assess water quality in the Chesnimnus basin). Data collection stations were installed prior to BPA project implementation. These records provide baseline information on stream water temperatures to help assess the effectiveness of BPA projects in reducing maximum stream water temperatures.

Stream water temperature was recorded with Ryan thermographs or maximum/minimum thermometers during June through August. A maximum stream water temperature was recorded for each month for the period of record prior to project implementation. If more than one year of record existed an average value was calculated. Each stream had temperatures exceeding 70 deg F during the period of record. These values along with post-project stream water temperature are shown in subsequent graphs.

Post-project maximum stream water temperatures were determined for each stream by using a computer model. The model is called TEMP86 and was developed by the Forest Engineering Department at Oregon State University. The mechanics of the model are based on Brown's stream water temperature study (Brown, 1969). TEMP 86 predicted maximum stream water temperatures based on post-project conditions due to riparian plantings (shade) and installation of instream structures (percentage of pools). Attainment of these predictions will take many years (>15 years). The actual time will depend on upland management, climatic behavior, and the success of plantings and instream structures.

Figure 4-l shows high monthiy maximum stream water temperatures during the summer months of 1980-1984 in Devil's Run. July and August had water temperatures of 74 and 73 deg F, respectively, above the project area. Temperatures, however, did not change through the project area. Post-project monthly maximum stream water temperature below the project area was predicted to be 68 deg F.

Above the project area in 1983 Elk Creek's maximum monthly stream water temperature increased over the summer (72 to 79 deg F). Figure 4-2 illustrates that no change in temperature occurs through the project area. Post-project monthly maximum stream water temperature below the project area was predicted to be 68 deg F.

Maximum monthly stream water temperatures for Peavine Creek are shown in Figure 4-3. Data was collected during 1981-1983 and 1986. The aspect of this creek is due South and because of the lack of sufficient pools and riparian vegetation stream water temperatures increased approximately 10 deg F through the project area. Monthly maximum stream water temperatures are high (78 - 80 deg F). Post-project monthly maximum stream water temperature below the project area was predicted to be 70 deg F.

FIGURE 4

MONTHLY MAX STEAMWATER TEMPERATURE

[Devil's Run, 1980 – 1984]

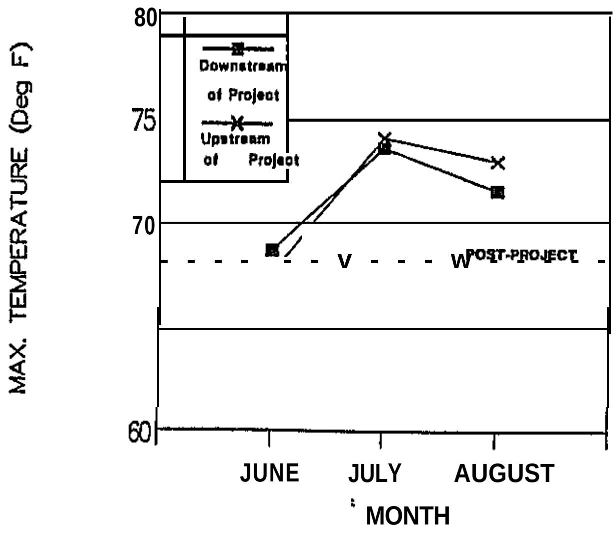


FIGURE 1. Maximum Monthly Streamwater Temperature

MONTHLY MAX STREAMWATER TEMPERATURE

[Elk Creek 1983]

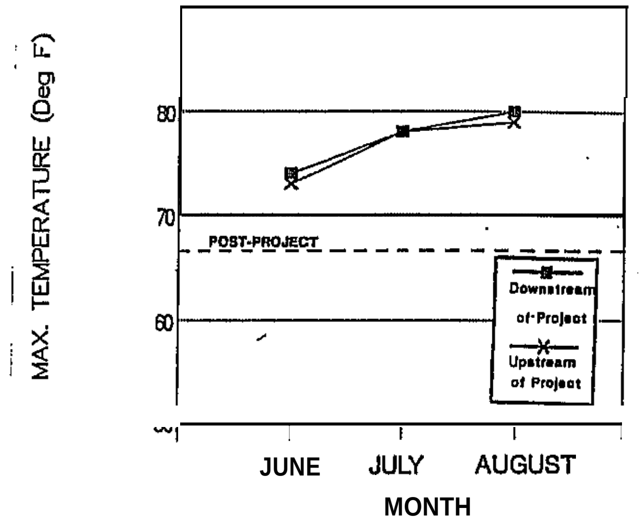


FIGURE 2. Maximum Monthly Streamwater Temperature.

MONTHLY MAX STREAMWATER TEMPERATURE

[Peavine Creek, 1981-1966]

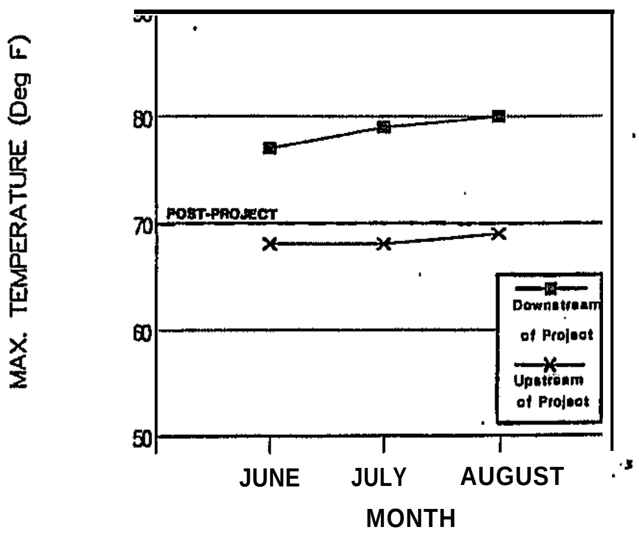


FIGURE 3. Maximum Monthly Streamwater Temperature.

RIPARIAN CANOPY DENSITY

[Inside fence exclosures]

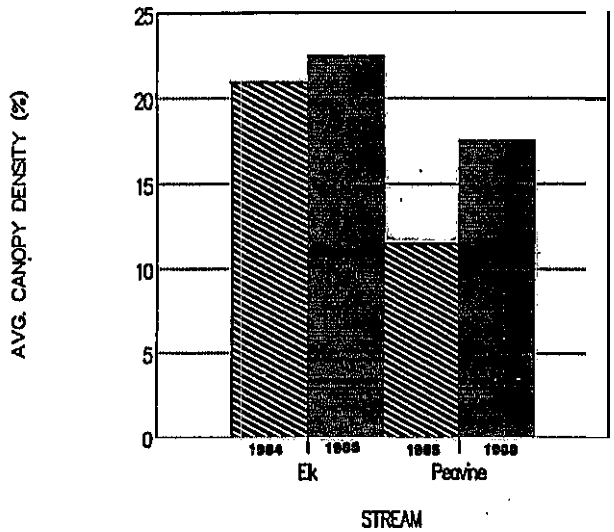


Figure 4. Riparian Canopy Density (within fence exclosures)

Ryan TempMentors will be used to record stream water temperatures in the summer of 1990 on all of the above streams. This information will be used in conjunction with the graphs above to assess the effectiveness of BPA projects in reducing summer maximum stream water temperatures.

Additionally, TempMentors have been installed this winter on Devil's Run and Peavine Creek. These temperature records will be used to assess winter stream water temperatures and water quality for over-wintering salmonids, and investigate changes in winter stream water temperatures, if any, as a result of BPA project implementation.

II. Pool Size and Distribution

A residual pool survey was conducted on Devil's Run during July of 1989 before BPA project implementation. Residual pools are pools that would exist when the discharge approaches zero. The survey method employed to collect residual pool information (i.e., area, volume) was devised by Lisle (1986, 1987). The advantages of using this method to investigate pool morphology is (1) independent of discharge (survey can be conducted any time of year), (2) objective, and (3) reproducible.

Two stream reaches within the Devil's Run Project area were surveyed on Devil's Run (above confluence with Chesinimnus Creek and above confluence with Summit Creek). The average volume of pools, the number of pools per 100 ft, and the percentage of pools within the reach were determined. These values are shown in the table below. This survey provides baseline information on pools and will allow determination of effectiveness of the project as future surveys are conducted.

Table 1. Pre-Project pool size and distribution on Devil's Run.

	@Summit Creek	@Chesnimnus Creek
Average pool volume (cu.ft.)	17.7	27.1
Number of pools/100 ft	0.3	1.0
Pools in reach (%)	8.1	18.5

The distribution of pools is low in both stream sections on Devil's Run. A stream survey conducted by Oregon Department of Fish and Wildlife in September of 1965 emphasizes the recent degradation of Devil's Run (Pools in reach @Summit Greek and @Chesnimnus Greek were 40% and 48%, respectively).

III. Riparian Canopy Desnity

Riparian canopy density measurements were taken in 1984/1985 and again in 1988 on Peavine and Elk Creeks. Measurements were recorded within BPA fence exclosures which had received riparian plantings. Approximately 10 locations on each stream were measured. The locations were marked with fence posts and labelled with metal tags for future referencing. Riparian canopy density was measured with a hand-held spherical densiometer using the technique developed by Platts and others (1983).

The results of these measurements are illustrated in Figure 4-4. The average riparian canopy density was 21% for Elk Greek in 1984 and 11% for Peavine Creek in 1985. In 1988 riparian canopy density slightly increased to 23 % for Elk Creek and increased to 17% for Peavine Creek. Riparian canopy density measurements, based on surveys conducted in the early 1970's in nearby streams, ranged from 50-75%. Reestablishing riparian vegetation to these levels and subsequent stream water temperature reduction of these streams is a slow process which may take 20 years or longer. Figures 5 and 6 show photographs of before riparian planting and after for Elk and Peavine Creek. Riparian vegetation is being established but its overall success will depend on the survival of plantings, species and quantity, their location along the stream, and upland management activities.

Periodic measurements are planned for these stream (approximately every 4-5 years). Additional riparian canopy density stations are planned for future enhancement streams (Chesnimnus, Devil's Run, and Swamp). These measurements provide invaluable information for determining the effectiveness of reducing solar input into the stream water.

IV. Miscellaneous

Retrieval and analyses of historical records (i.e., wood volumes, stream bottom substrate) are in progress. All existing instream structures were inspected and photographed, Camera Points were established on Chesnimnus Creek (Section E (4)) and Devils Run Creek (4). Existing Camera Points were photographed, Elk Creek (2) and Peavine Creek (6). Temperature Stations were monitored and the data recorded. Historical and current data is being entered into a District Data Base, this project is ongoing and will continue as time and funding permit.

Project XIII · WAV Maintenance

Chesnimnus Creek

Starting in the spring and at monthly intervals, 12 miles of 4-strand barbed wire fence was maintained, at weekly intervals the Vance Draw powered offset was inspected and maintained as necessary.

Elk Creek

Maintenance was completed on 5.8 miles of fencing (4-strand barbed wire) designed as 9 exclosures. Following inspection, no maintenance was required on instream structures.

Peavine Creek

Maintenance was completed on 5.5 miles of "New Zealand" style high tensile electric and 1.0 miles of 5-strand barbed wire fence. Following inspection, no maintenance was required on instream structures.

Proiect XIV · Trail Creek Instream Structures · Baker Ranger District

Trail Creek and its tributaries, North, Middle, and South Trail creeks, drain approximately 22 square miles of the headwaters of the North Fork John Day River. Trail Creek enters the North Fork John Day River near the North Fork John Day campground. A 1987 physical habitat inventory revealed a pool:riffle ratio of 18:65 and a 1988 COWFISH Habitat Capability assessment estimated Trail Creek as 58% of optimum habitat, being deficient in undercut banks and overhead cover. Watershed uses and impacts include past sheep grazing, timber harvesting, and mining. The sheep allotment is now vacant.

Instream habitat improvement structures were to be implemented on 1.9 miles of main Trail Creek in FY 1989. Specific objectives were: 1 rock and 15 log weirs, 114 boulder clusters, 10 boulder wing deflectors, and 50-69 whole tree additions. Photo points were to be established. Work accomplished in FY 1989 included hydraulic excavator contract preparation and award. Coordination with the Wallowa-Whitman Burnt Powder Engineering Zone to provide a back-hoe, front-end loader, and boulder and tree/log delivery was completed. A Cultural Resource Inventory of the project site was also completed. The August 1989 fires interrupted the project schedule and implementation was postponed until FY 1990.

Other tasks completed in FY 1989 were a project re-design, with the design now including 3 boulder weirs, 10 boulder clusters, and 450 whole trees to be used for construction of bank erosion stabilizers, cover, and habitat complexity; and an updated baseline USFS Region 6 Riparian/Aquatic Survey for physical habitat conditions. Final photo points will be established in spring 1990.

Project XV North Fork John Day Fishery Habitat Planning · Baker & Unity

There are five tributaries (Beaver, Bull Run, Granite, Olive, and Onion creeks) to the North Fork John Day River on Baker and Unity Ranger Districts which had detailed fisheries habitat inventories completed in FY 1987, In FY 1988 the COWFISH Habitat Capability assessment was applied to Beaver and Bull Run creeks, and a preliminary project plan was designed for Beaver Creek.

Specific objectives (biological inventory, final design, mapping and site staking) outlined in FY 1989 for these five tributaries of the North Fork John Day River (and Corral Creek) were not accomplished due to the lack of a district level fish biologist from December 1988 until September 1989. During FY 1989 out-year budget and implementation scheduling was prepared for North Fork John Day River tributaries which were designated for project work in the Wallowa-Whitman National Forest Fish Habitat Improvement Implementation Plan of January 1988. These tributaries are Middle and South Trail creeks, Beaver Creek, Bull Run Creek, and Granite Creek. During fall 1989 the Baker District Fisheries Biologist visited Beaver, Bull Run, and Granite creeks; and established contacts with ODFW and the Confederated Tribes of the Umatilla.

SUMMARY AND CONCLUSIONS

Significant progress has occurred toward improving fisheries resources in the two project subbasins. Recognition of the need to treat habitat units with a combination of treatments is now widespread. Habitat diversity improvements have evolved from single, "hard" engineered structures to diverse, "soft" engineered combination of treatments more representative of natural systems. Also recognized is the need to protect instream improvement investments with strict and judicious management and administration of riparian zones. Research and management applications continue to evolve, along with the understanding that there is no "quick fix." Significant effort is and continues to be focused on clearly measuring and defining riparian management objectives.

System and subbasin planning efforts are proving instrumental in reaching short term improvement goals and providing long-term direction. The Wallowa-Whitman recognizes the abundant opportunities for habitat improvement and is meeting its goal to provide expert fisheries staffing at the district level for all forest subbasins.

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Uberuaga, Richard. 1988. Wallowa-Whitman NF Fish Habitat Improvement Implementation Plan. USDA Forest Service, Baker, Oregon.

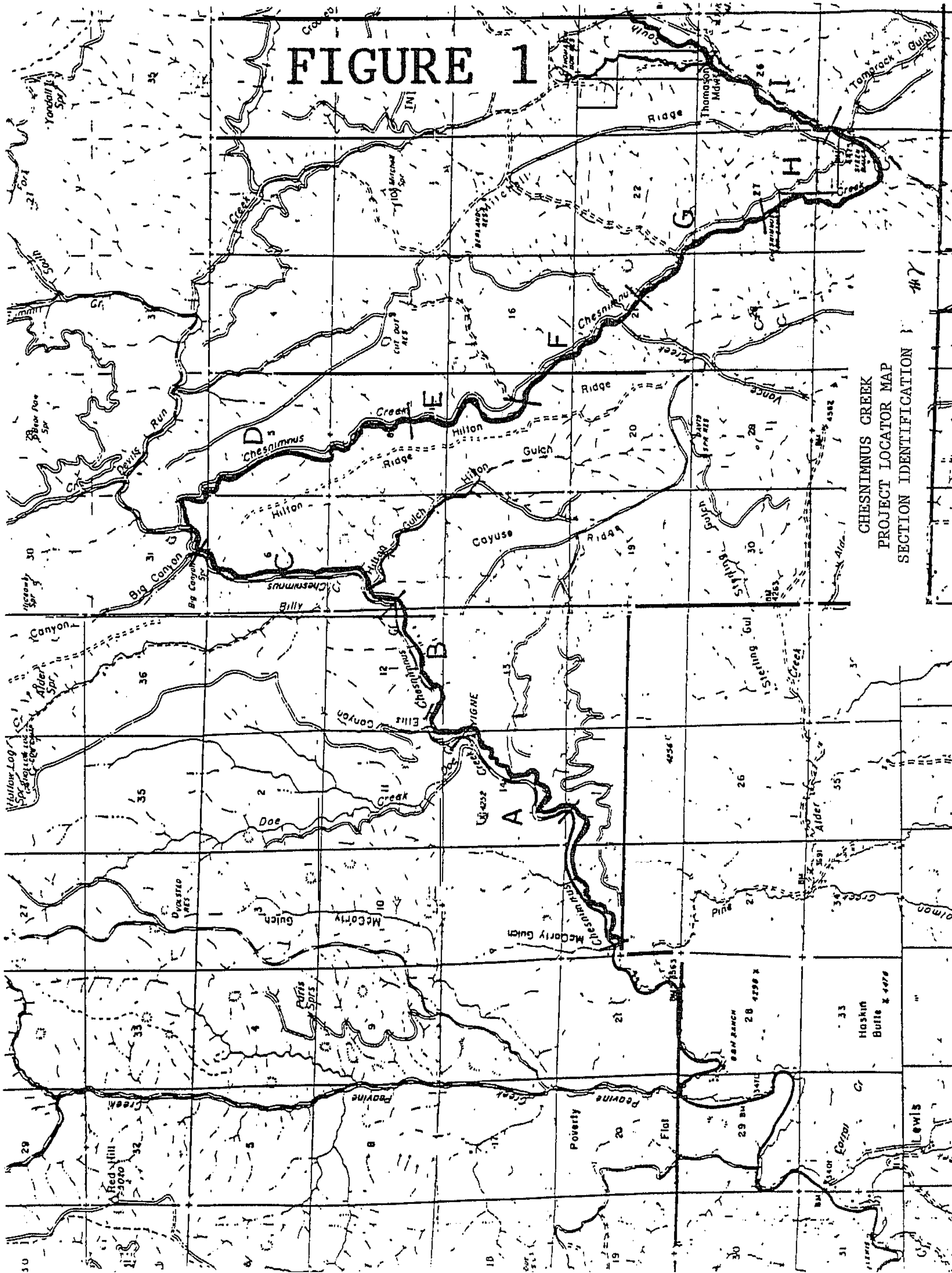
APPENDICES

APPENDIX I

BPA-USFS PROJECT LOCATOR MAPS

TABLE OF CONTENTS

FIGURE 1



CHESNIMNUS CREEK
PROJECT LOCATOR MAP
SECTION IDENTIFICATION

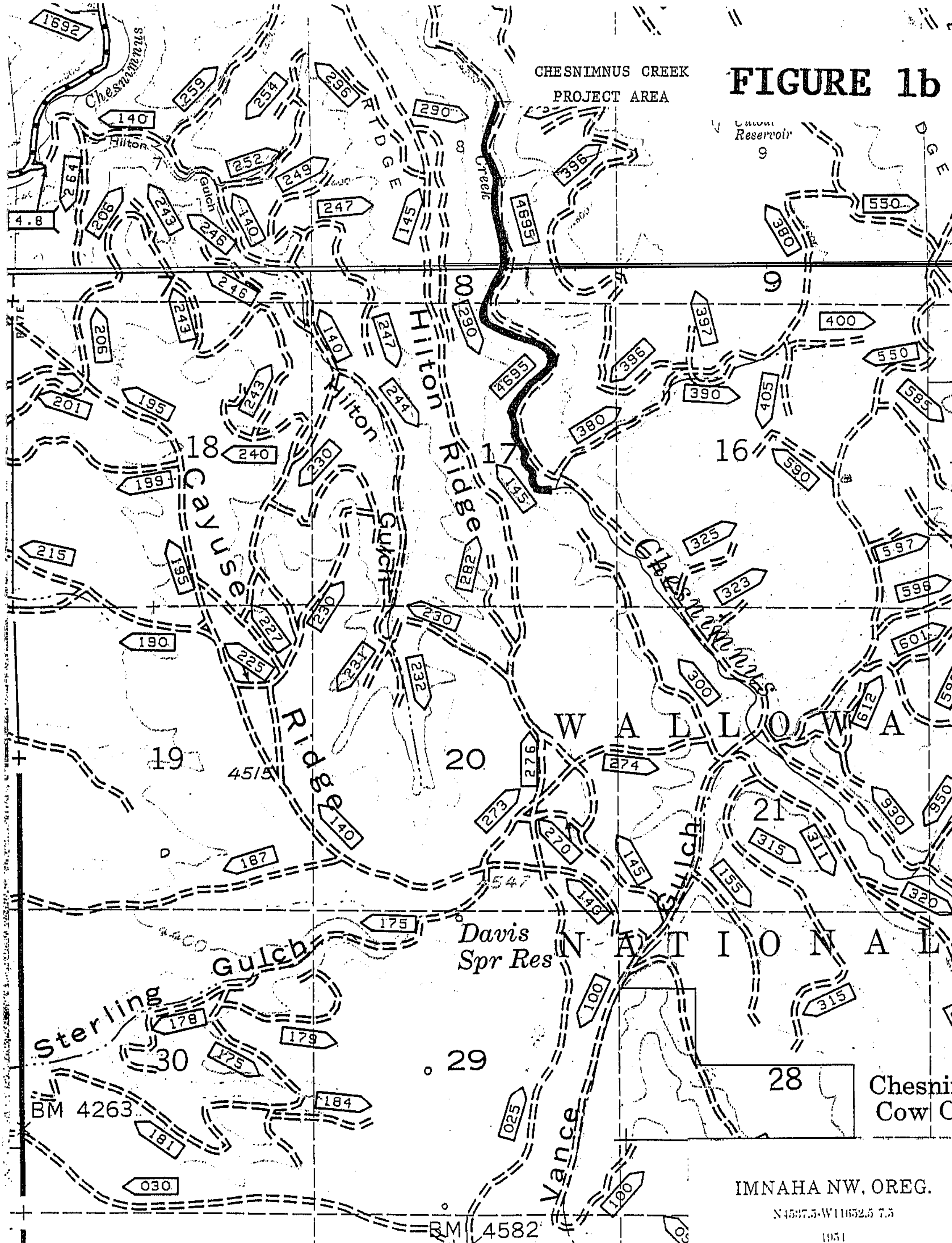


FIGURE 1b
CHESNIMNUS CREEK PROJECT AREA
Chesnimnus
Hilton
Gulch
Creek
Reservoir
Hilton Ridge
Cayuse Ridge
Hilton Gulch
Chesnimnus
WALLOWA
NATIONAL
Gulch
Davis Spr Res
Sterling Gulch
Vance
BM 4263
BM 4582
4515
Chesnimnus Cow C
IMNAHA NW, OREG.
7
8
9
16
17
18
19
20
21
28
29
30

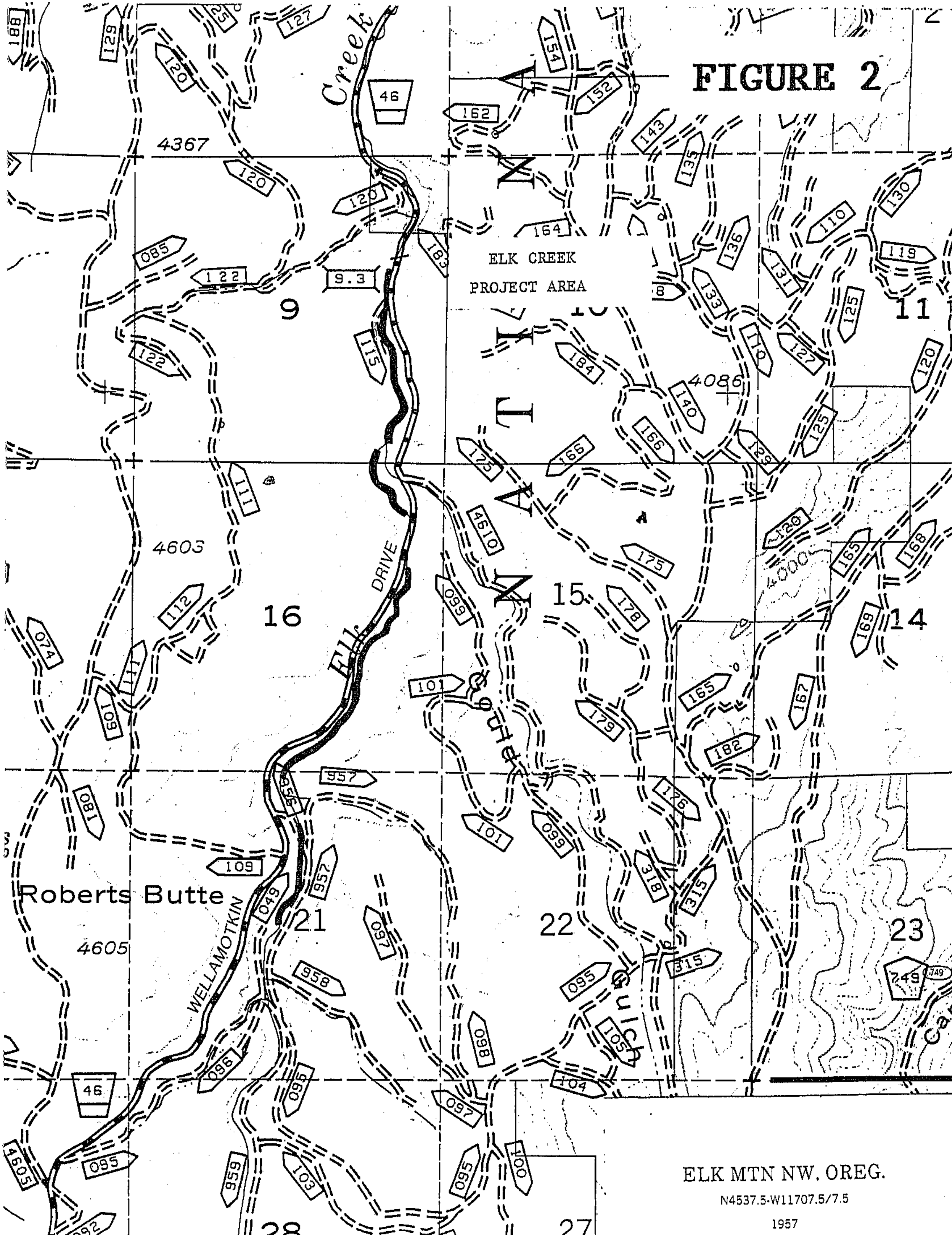


FIGURE 2
ELK CREEK
PROJECT AREA
Creek
Elk Drive
Wellamotkin
Roberts Butte
Gulch
ELK MTN NW. OREG.
N4537.5-W11707.5/7.5
1957

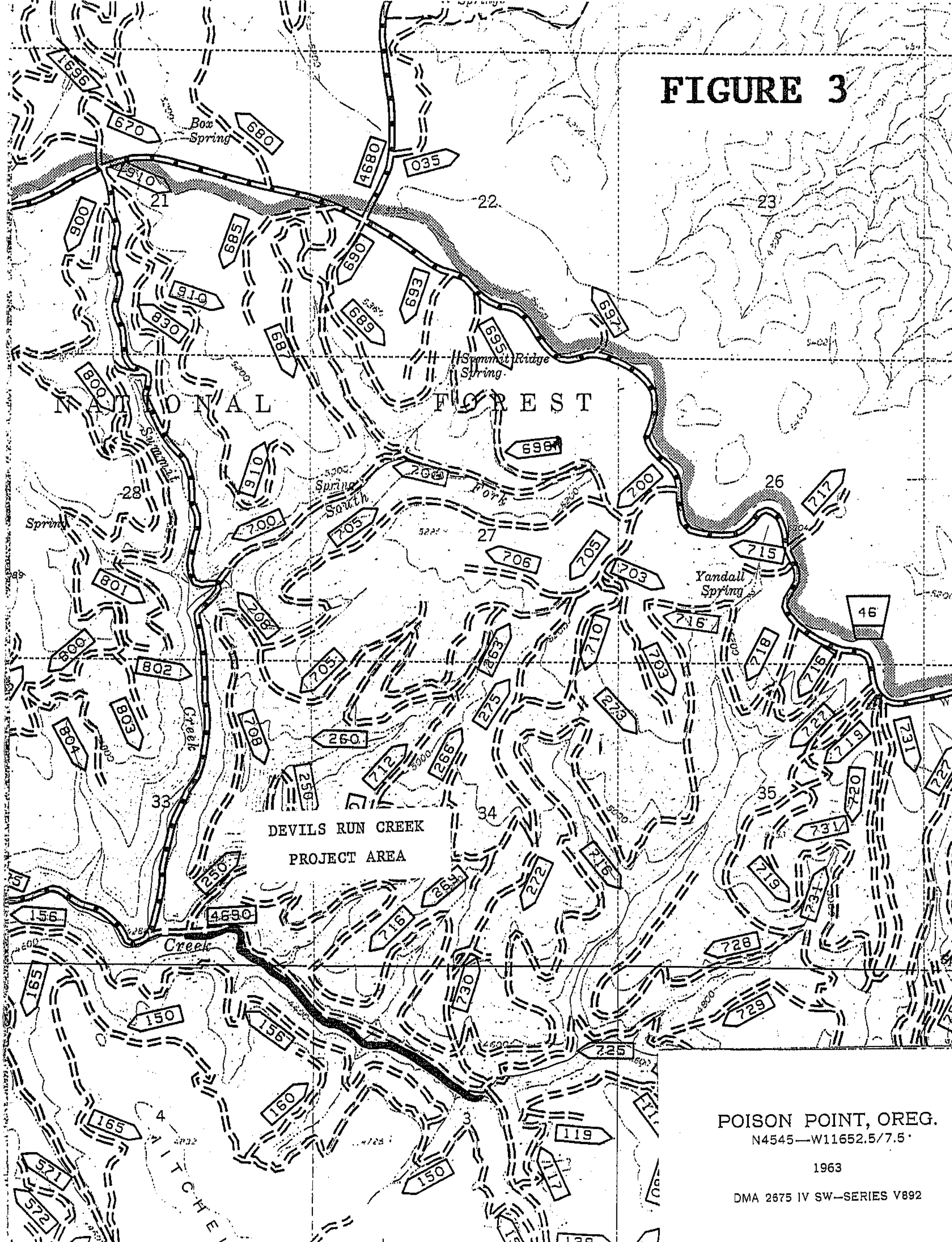

DEVILS RUN CREEK
PROJECT AREA
NATIONAL FOREST
Box Spring
Summit Ridge Spring
Yandall Spring
South Fork
Summit Creek
Creek
POISON POINT, OREG.
N4545—W11652.5/7.5
1963
DMA 2675 IV SW—SERIES V892

FIGURE 3

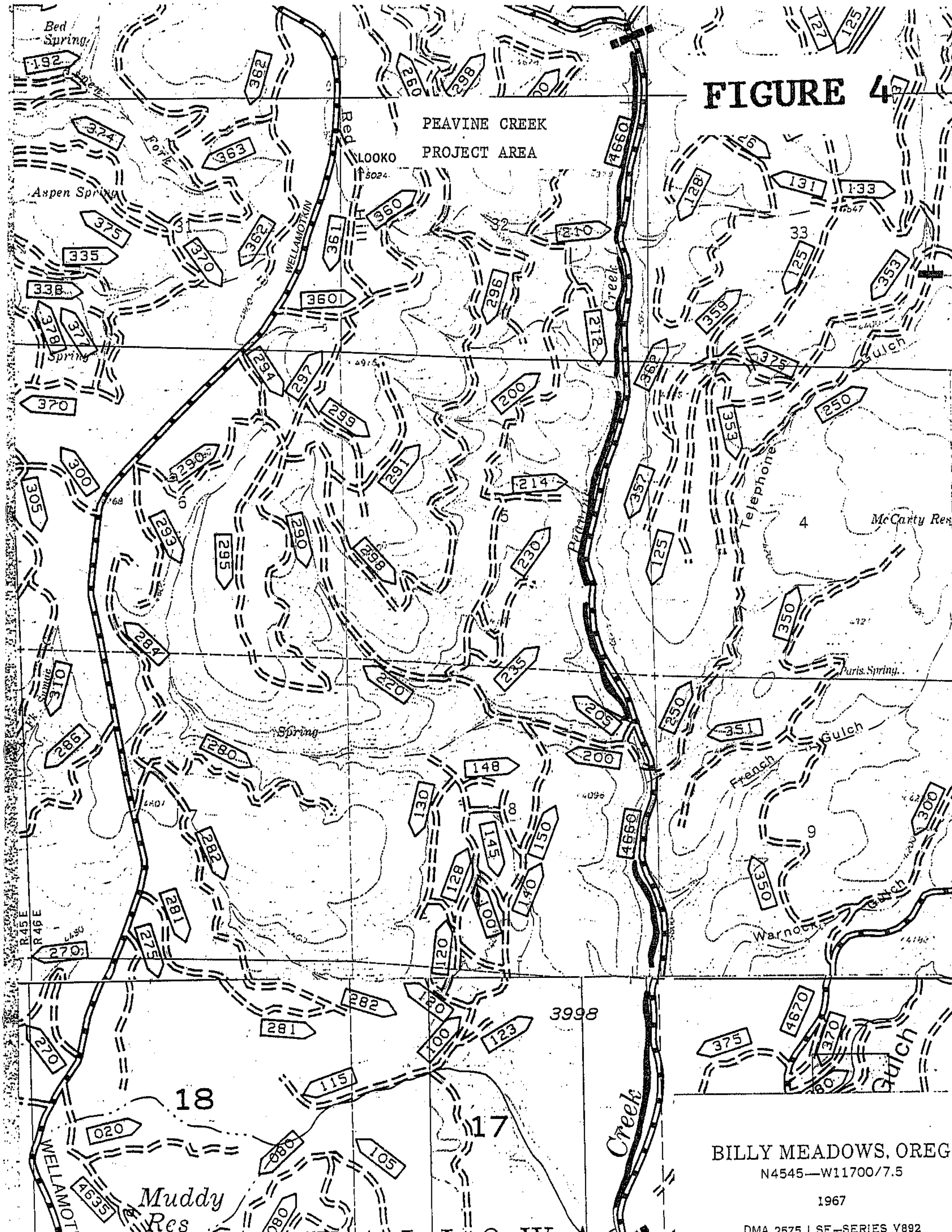
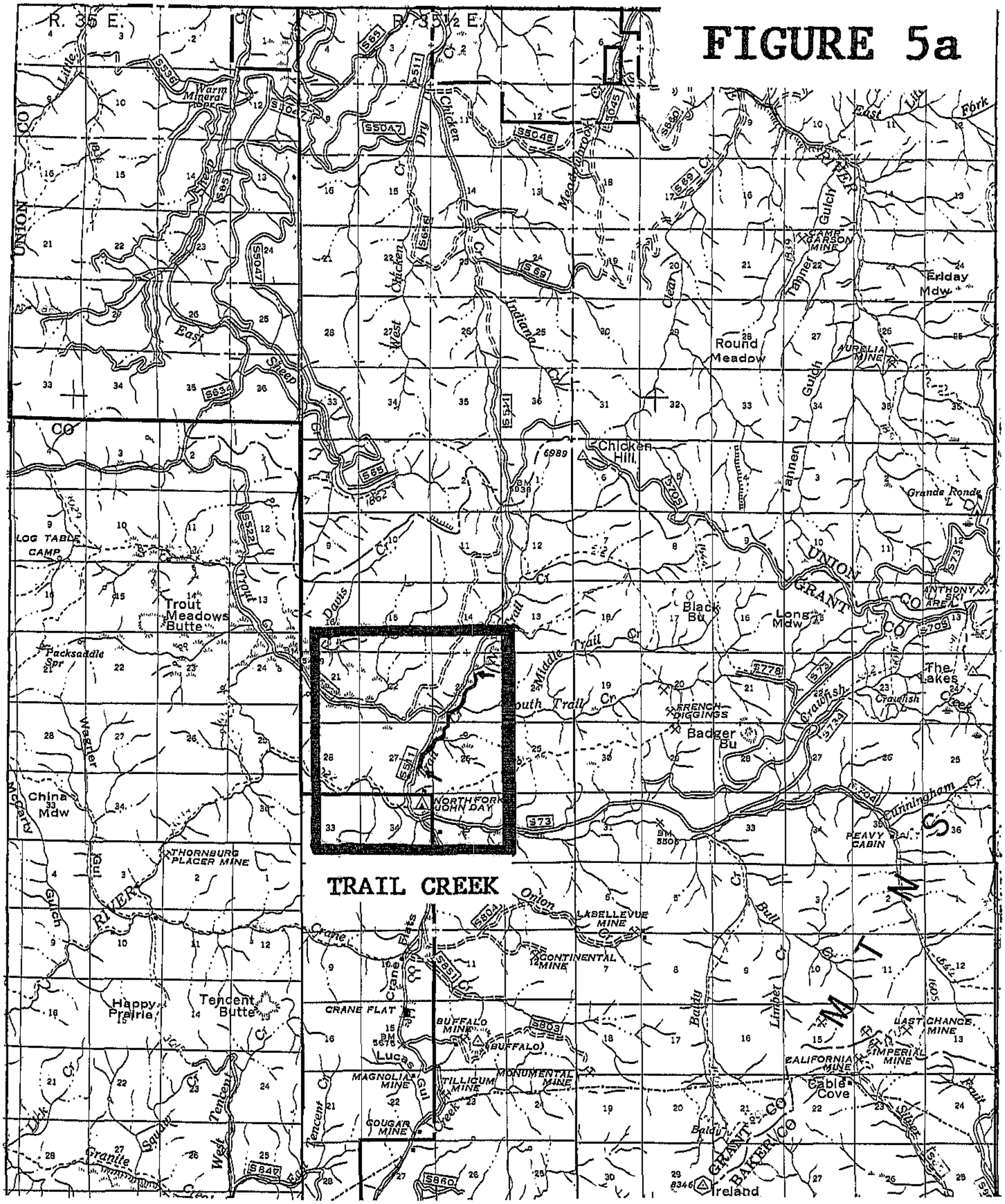


FIGURE 4
PEAVINE CREEK
PROJECT AREA
Bed Spring
Aspen Spring
WELLAMOTKIN
Telephone
McCarty Res
Paris Spring
French Gulch
Warnock Gulch
Muddy Res
Creek
18
17
3998
R45E R46E
BILLY MEADOWS, OREG
N4545—W11700/7.5
1967
DMA 2575 I SE—SERIES V892

FIGURE 5a



NORTH FORK JOHN DAY SUBBASIN

USFS - BPA

PROJECT STREAM

FY89

FIGURE 5b

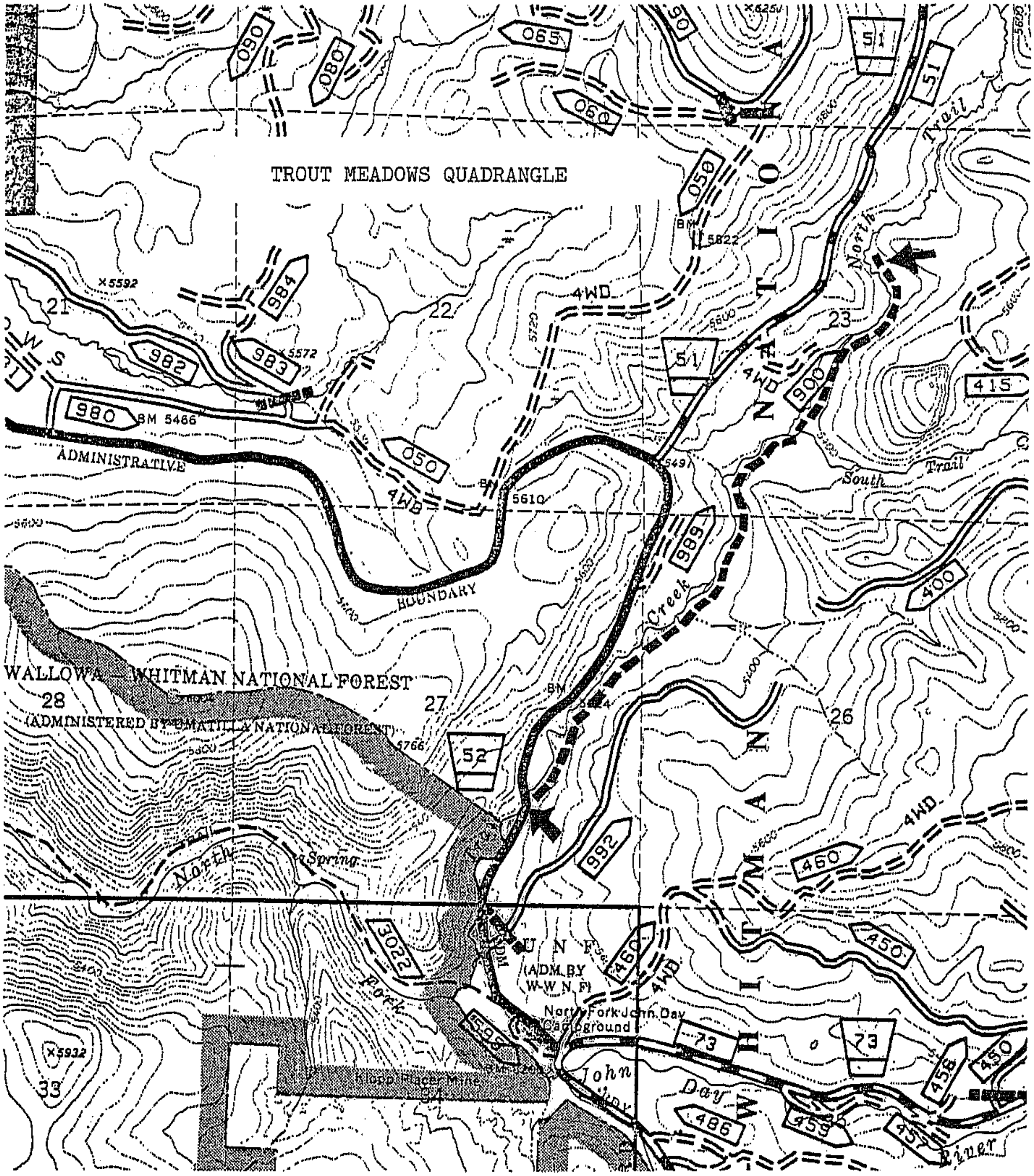
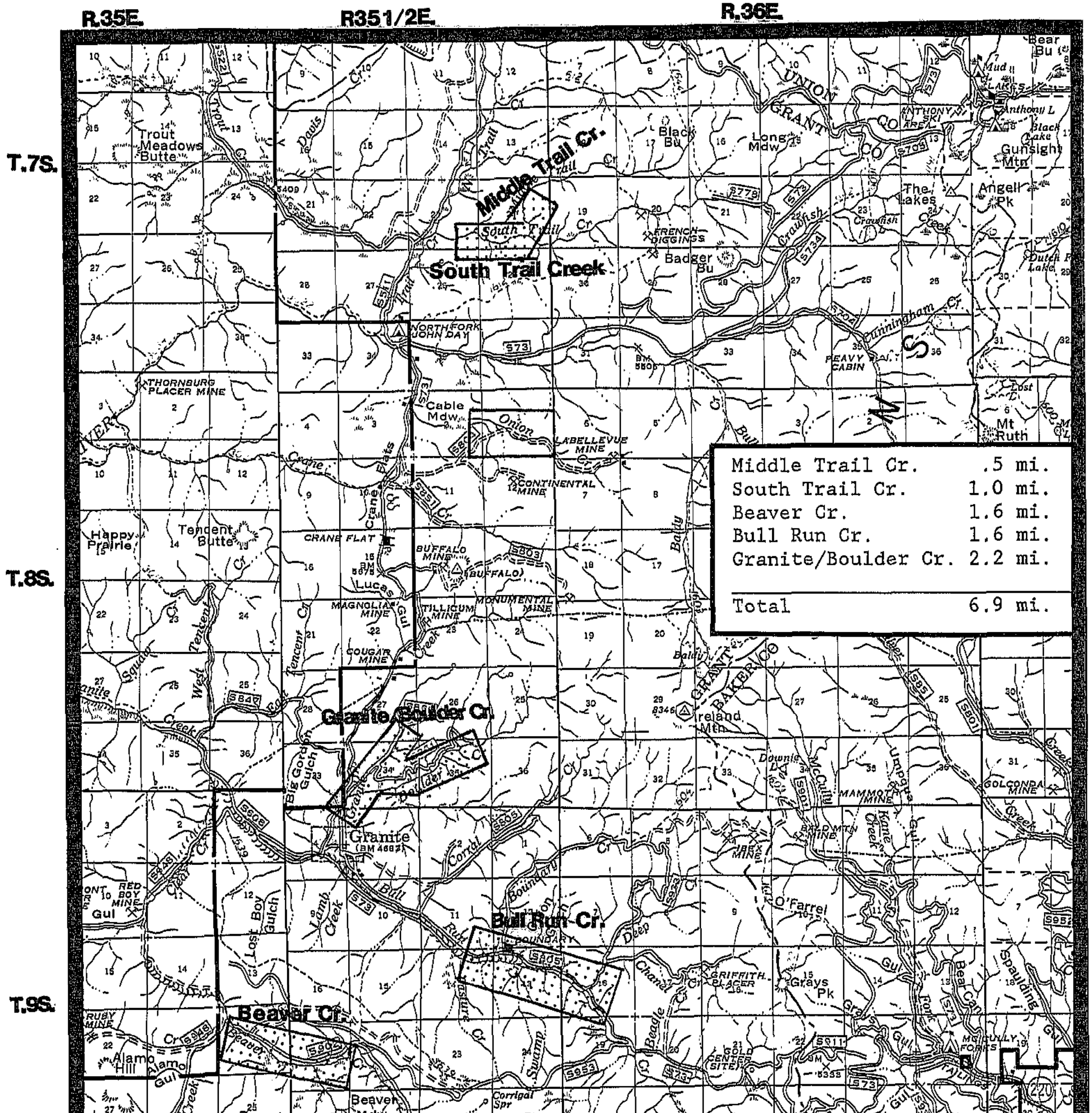


Fig. V. Trail Creek Project Area.

FIGURE 6



TRIBUTARIES TO NORTH FORK JOHN DAY
PROJECT PLANNING AND IMPLEMENTATION
BAKER AND UNITY RANGER DISTRICTS

FIGURE 7

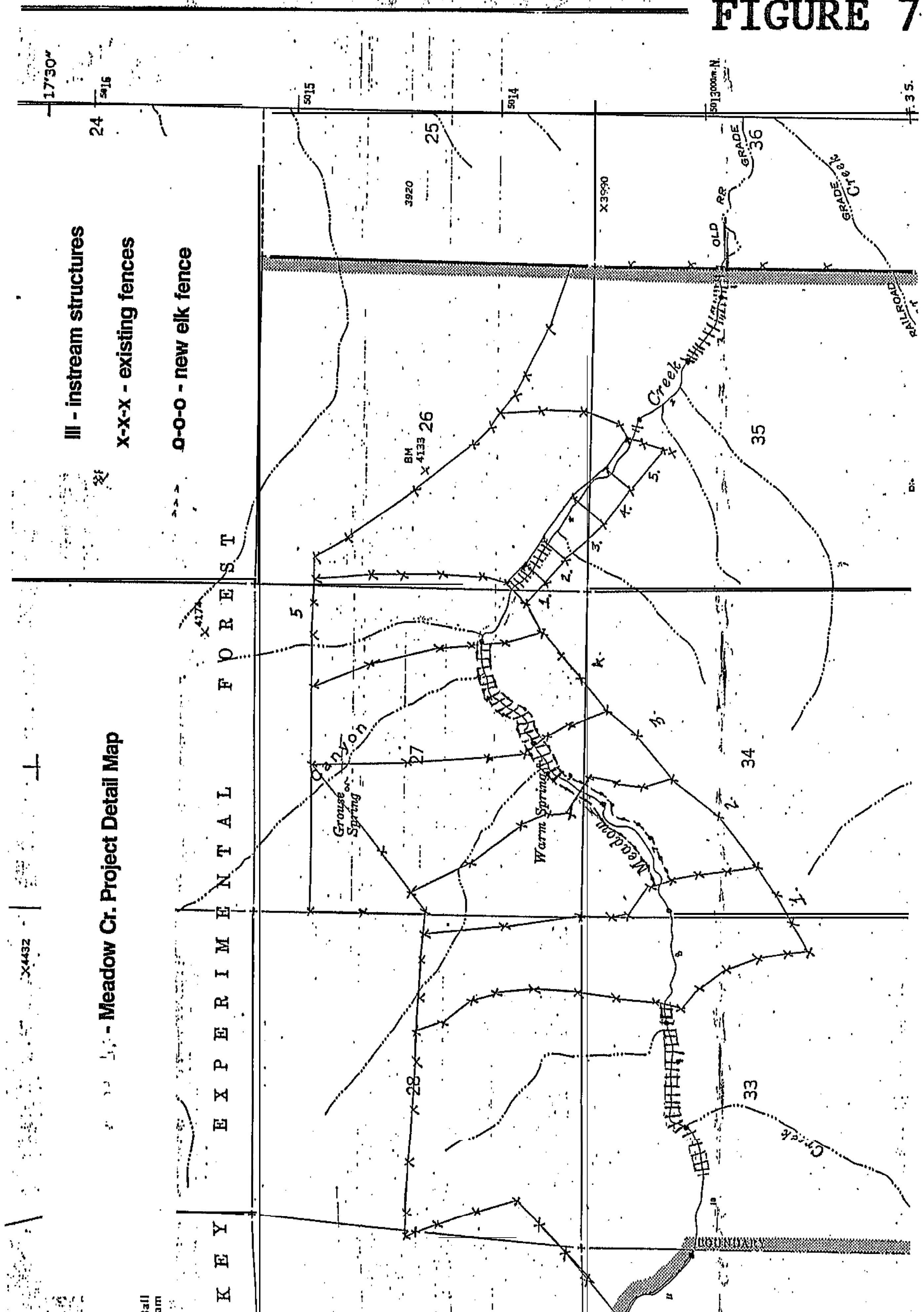
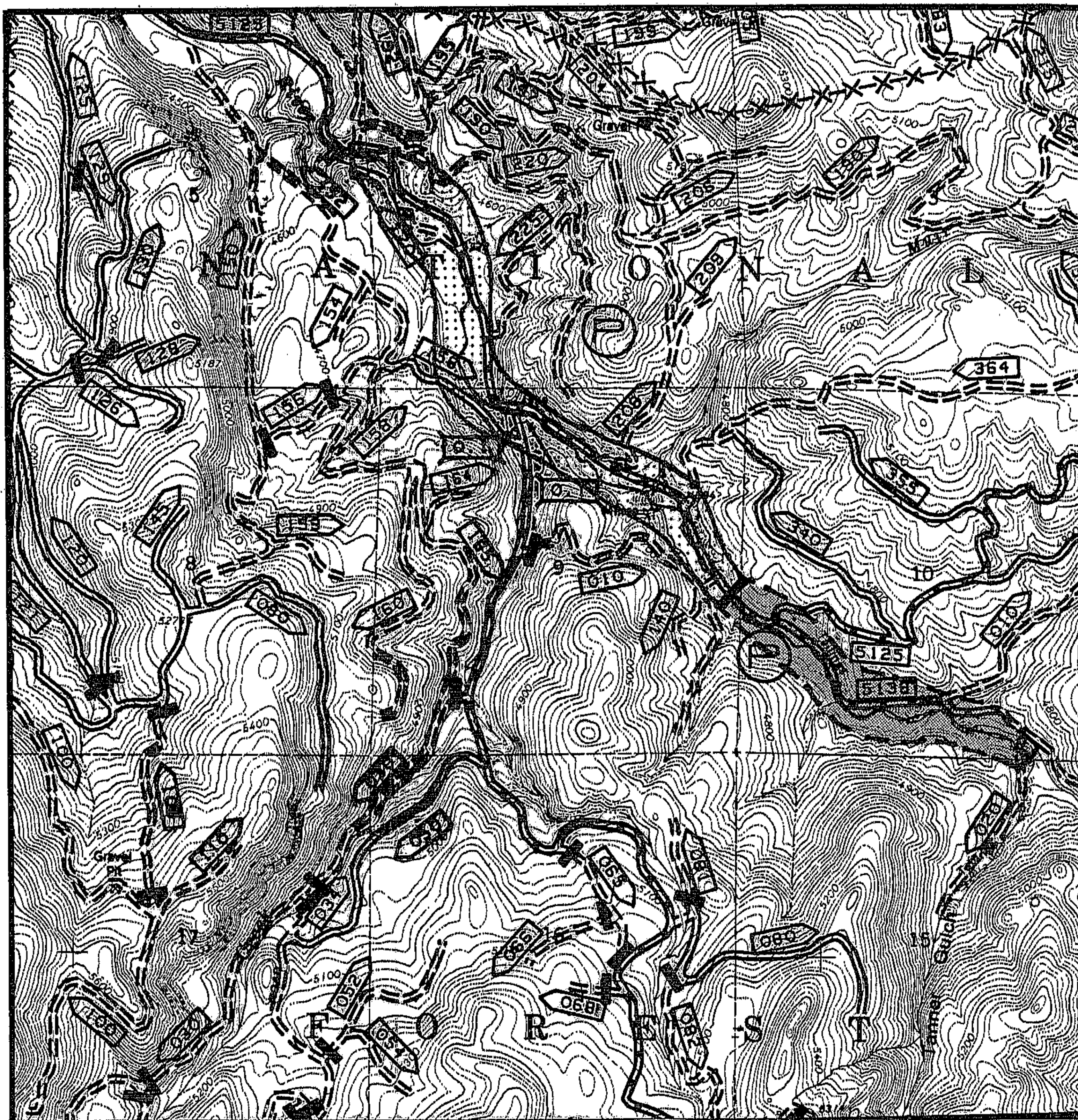

III - instream structures
X-X-X - existing fences
O-O-O - new elk fence
Meadow Cr. Project Detail Map
EXPERIMENTAL FOREST
Canyon
Grouse Spring
Warm Spring
Meadow
Creek
OLD RR GRADE
GRADE
RAILROAD
BOUNDARY
24
25
26
27
28
33
34
35
36
5
BM 4133
3920
X3990
X4432
17'30"
5013000m.N.

FIGURE 8



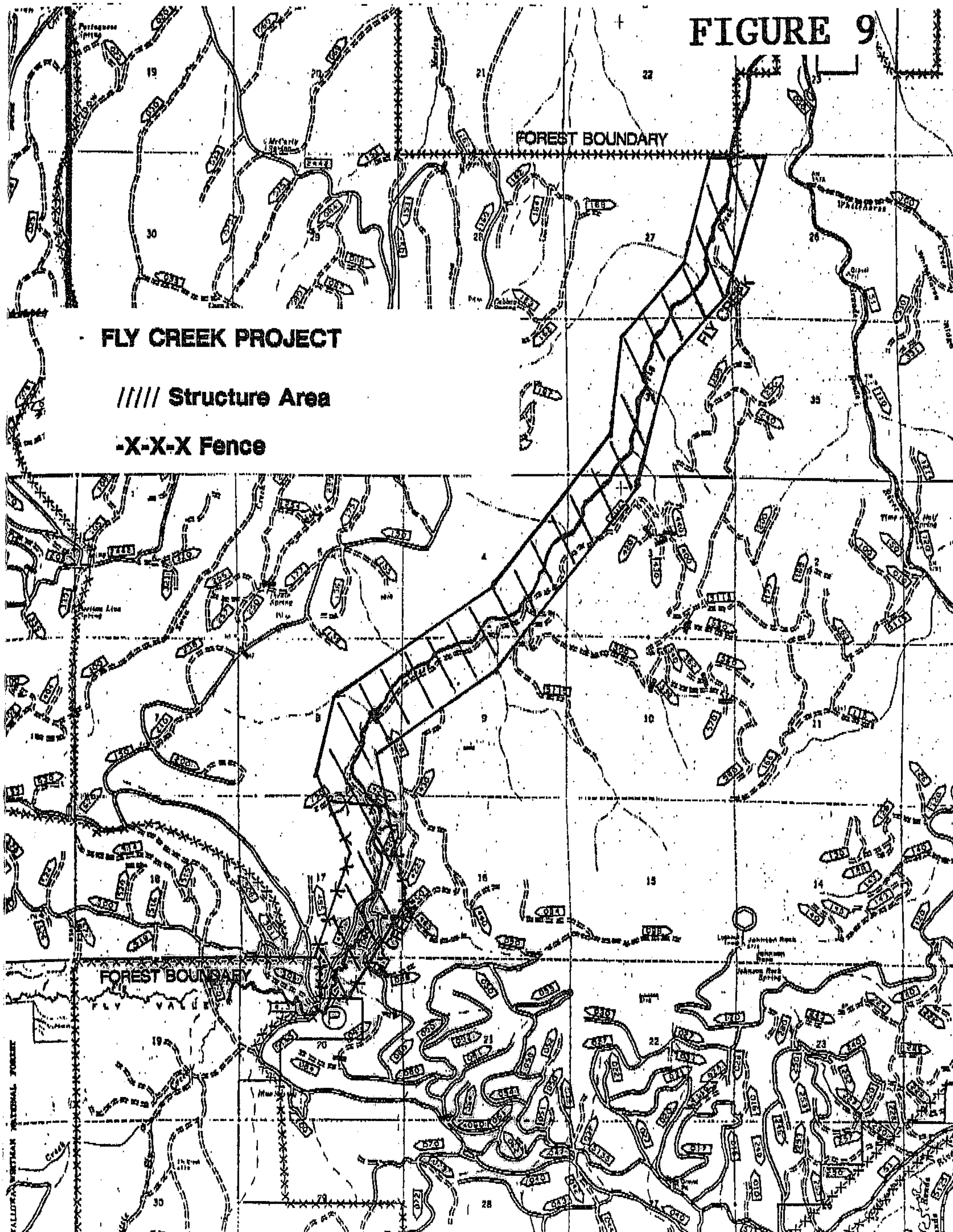
UPPER GRANDE RONDE RIVER PROJECT

FISH HABITAT ENHANCEMENT STRUCTURES

COMPLETED ENHANCEMENT —

PROPOSED ENHANCEMENT - - -

FIGURE 9

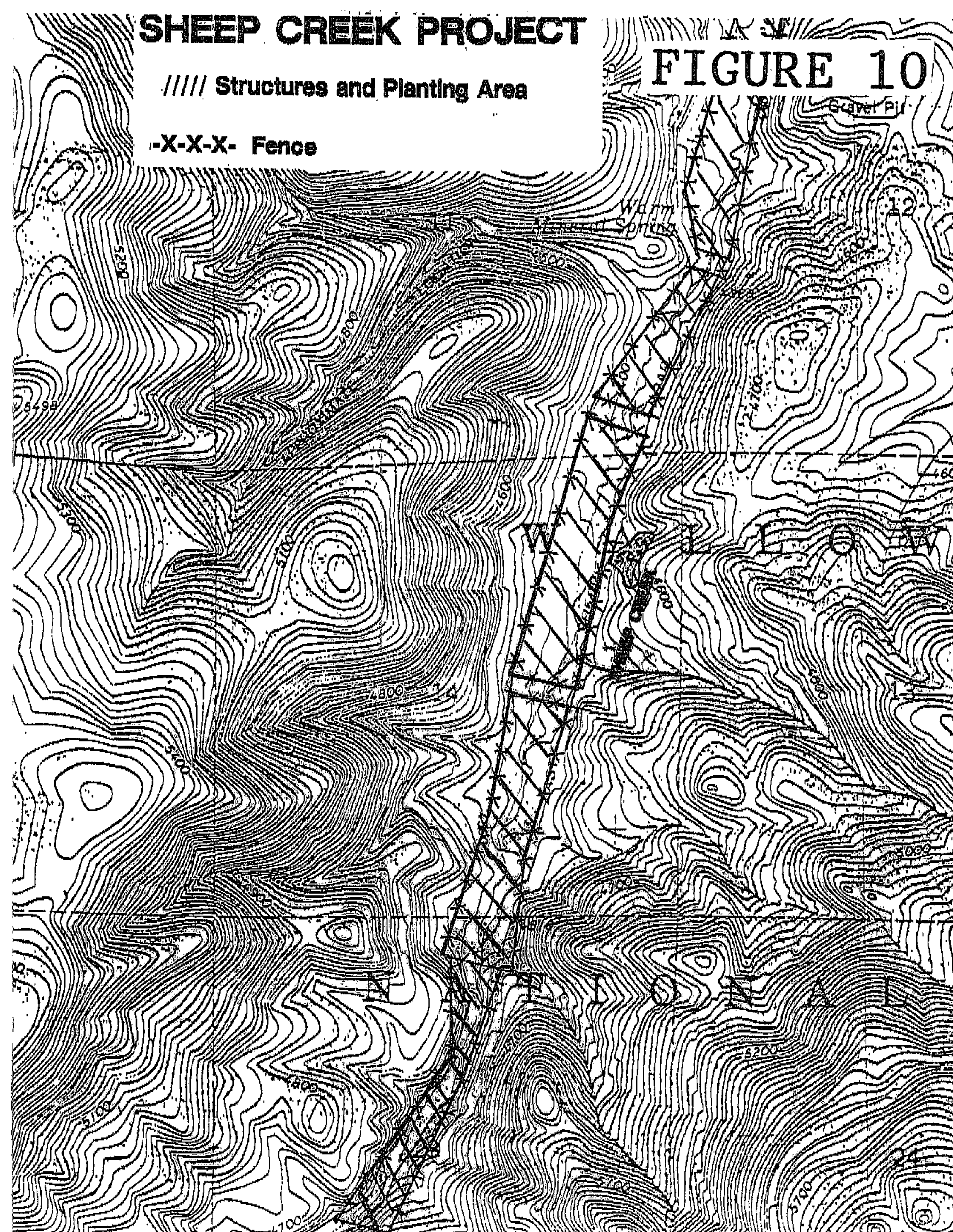

FLY CREEK PROJECT
///// Structure Area
-X-X-X Fence
FOREST BOUNDARY
FOREST BOUNDARY
FLY CREEK

SHEEP CREEK PROJECT

///// Structures and Planting Area

-X-X-X- Fence

FIGURE 10



APPENDIX II

STREAM MONITORING PLAN - MACROINVERTEBRATE BIOASSESSMENT
DRAFT

I. GOALS

The overall goal of this monitoring plan is to provide baseline data on water quality in the major watershed sub-basins of the Grande Ronde River within the La Grande Ranger District. These data can be used to help determine which streams could be most cost-effectively managed or improved for fisheries, and they could also be used to identify point and non-point sources of pollution that might impair fish production and survival.

II. SAMPLE SITE LOCATION

To meet this goal, sample sites should be located on the major (at least 3rd order) Grande Ronde River tributaries that have most of their watershed area located within the La Grande Ranger District. When possible, locations should be accessible by vehicle in different seasons. Data analysis involves comparison of sample sites to reference sites representing the best conditions present in the area. If stream impairment is detected, additional sample sites may be located in sub-drainages to help locate and monitor the pollution source.

In the field, most sample sites can be marked with red, metal fence posts; if necessary, green posts should be used along major public roads. The site ID can be scratched and painted on each post and it also should be stamped into an aluminum tag attached to the post. Posts are unnecessary at readily identifiable locations and should be avoided on private land.

III. SAMPLING PROTOCOL

A. Introduction.

The EPA (Plafkin, et al., 1989) is proposing a set of procedures for biological assessment of stream and river water quality for use nationwide. Shackleford (1988) used similar procedures in Arkansas. Wisseman and Miller (1989) propose slight modifications for use in the Pacific Northwest. A potential strength of these procedures is that the data are used to generate several different measures (biometrics) of water quality that are considered as a group in a final assessment of stream impairment. The EPA suggests eight biometrics, and Shackleford used some alternative ones; Wisseman and Miller propose adding some of Shackleford's, some of their own, and the Biotic Condition Index (BCI) of Winget and Mangum (1979) to the EPA biometrics. Although developed for use in the Intermountain Region, the BCI has been used by Mangum for analyzing streams in Western Oregon. The BCI has a potential shortcoming in that it is likely to assign the same potential community tolerance level to all of our streams (this is the same level that also was assigned to all 16 sample sites on 5 streams near Salem (Mangum, 1983) and 10 sites on 4 streams near Eugene (Mangum, 1985)). No one knows yet which biometrics will best discriminate different levels of water quality in our area. It may be that the BCI will be sufficient, but since few additional data are necessary to generate the other biometrics the EPA protocol with some of Shackleford's alternatives and Wisseman and Miller's additions will be followed for now.

B. Habitat Evaluation.

In order to discriminate differences in water quality on the basis of the macroinvertebrate community it is important that sample sites be located in areas of comparable habitat. If possible, riffles chosen for sample sites should have similar in-stream substrate and bank characteristics. Comparability is assessed as part of the EPA protocol; the data form (Attachment C) can be completed in about 5 minutes. The EPA protocol also includes a form (Attachment B) for recording the general physical characteristics of the sample site; this form, with the addition of two parameters, can be completed in about 10 minutes. The habitat evaluation needs to be done only once, unless obvious changes occur.

C. Water Physico-chemical Parameters.

The EPA protocol includes measurement of some standard physical and chemical parameters of the water at the sample site (Attachment B); two chemical analyses (sulfate and total alkalinity) have been added to allow determination of Winget and Mangum's BCI biometric. Calcium hardness, total hardness, phosphate concentration, and nitrogen (as nitrate) concentration were added for additional data interpretation.

D. Macroinvertebrates.

Samples should be taken with a Surber sampler from riffles between 10 and 15 cm deep; subsamples should be taken at the-head, middle, and tail of the riffle, with an attempt to sample both fast and slow riffle area, and combined as collected into one composite sample. This procedure is similar to the EPA proposal and Shackleford's technique. Both Winget and Mangum (1979) and Wisseman and Miller (1989) suggest taking three separate samples at each site to allow for statistical analysis and estimation of organism density. However, even "quantitative" samplers like the Surber sampler are not very good for yielding consistent density estimates and Peckarsky (1984) notes that many more than 3 samples must be taken to give reliable estimates of average density or biomass. Semi-quantitative (relative density) and qualitative data are sufficient for the biometrics 'used in this protocol, and these types of data are better collected by subsampling several different specific locations than by taking a few, randomly selected, individual samples. Wisseman (phone conversation) basically agreed with this conclusion, although Mangum (phone conversation) still believes that three separate samples are sufficient to get reliable density estimates (he seems to be alone in this conclusion). A single sample also reduces by two-thirds the cost of identifying the invertebrates. Fred Mangum (Aquatic Ecosystem Analysis Lab, USDA Forest Service, R-4, 105 Page School, Brigham Young University, Provo, UT 84602; 801-378-4928) provides the lowest cost sample analysis although his lab doesn't identify the Chironomidae beyond family level; he doesn't think it is important to do so, but Weissman does think it is necessary because of variations in tolerance in this family. Details of the sampling procedures are in Attachment D.

Sites can be sampled one or more times per year. Mangum and Wisseman (phone conversations) agree that an appropriate sampling time for our area would be early fall or late summer (September · October) after the summer generation has a chance to reach late instar stage. If sampling is done in the spring it must be spread-out temporally to equalize altitudinal differences in snowmelt and phenology.

The following biometrics will be used initially to determine water quality; some may be deleted and others added as we learn which are most appropriate for our area. More detailed explanations and rationales for each can be found in the EPA document (Plafkin, 1989) and in Wisseman and Miller (1989); calculation instructions are in Attachment E. Nearly all of the biometrics involve comparison between a calculated value for the sample site and a similar value for a site on a reference stream. The latter can be upstream from the sample site (as when bracketing a point pollution source) or it can be on a stream representing the best conditions available. The reference data can also be a composite from several best-condition streams. Whichever sites turn out to have the overall highest physical and biometric values will be used to provide the reference data.

1. Taxa Richness - based on number of different taxa; better quality sites are expected to have more different species.

2. Modified Hilsenhoff Biotic Index (HBIm) - summarizes the overall pollution tolerance of the existing macroinvertebrate community by averaging the tolerance values of each taxon present weighted by the number of individuals of each taxon. Tolerance values for some of our taxa may have to be determined as this index was created in Wisconsin. This biometric may eventually be deleted if the BCI (biometric 3) proves more discriminatory.

3. Modified Winget and Mansum's Biotic Condition Index (BCIm) - this index also summarizes overall community tolerance, but the comparison is made to the stream's own potential (based on 4 habitat parameters) instead of to a reference stream. This index was developed in Utah, but has been used in Oregon and tolerance values for most taxa are already available. The modification is a simple weighting of tolerance values according to relative density. This biometric may eventually be deleted if the HBI (biometric 2) proves more discriminatory.

4. Ratio of Scrapers to Filtering Collectors - predominance of either functional feeding group may indicate an overabundance of a particular food type. Excess Filtering collectors often indicates the presence of large quantities of fine particulate organic material (FPOM) associated with organic pollution. Scarcity of filtering collectors may indicate toxicants absorbed onto the FPOM.

5. Ratio of Shredders to Others - scarcity of shredders can indicate a scarcity of coarse organic particulate material (CPOM) or the presence of toxicants absorbed onto the CPOM. The EPA protocol calls for the collection of a separate sample of CPOM (leaves, twigs, etc.) from wherever they are found in the sample site. CPOM is minimal in many of our streams and this biometric may need to be deleted unless sufficient amounts of CPOM or numbers of shredders are collected in the riffle samples.

6. Ratio of EPT Abundance to Chironomid Abundance - Ephemeroptera (mayflies), Plecoptera (stoneflies) and Tricoptera (caddisflies) tend to be sensitive to pollutants and Chironomids (Diptera; midges) tend to be tolerant. A fairly even distribution of these four groups indicates good biotic conditions.

7. EPT Index - the total number of distinct taxa within these three sensitive orders should be highest in good quality water.

8. Percent Contribution of Dominant Taxon - increasing relative abundance of a single taxon indicates greater environmental stress. Comparison to a reference site is not necessary for this biometric.

9. Dominant Taxa in Common (DTIC) - compares the dominant five taxa of the sample site and reference site. Pollution tolerant species are present in most streams but are dominant only in polluted ones.

10. Common Taxa Index (GTI) - compares the number of taxa present at both the sample site and the reference site.

11. Community Loss Index (CLI) - based on the absence at the sample site of taxa present at the reference site.

12. Missing EPT Genera - compares the occurrence of common genera (relative abundance > 4%) of Ephemeroptera, Plecoptera, and Tricoptera at the sample and reference sites,

Each biometric will be scored and an overall assessment made as follows:

	Metric	Biometric Score 6	4	2	0
1.	Taxa Richness*	> 80%	60 - 80%	40 - 60%	< 40%
2.	Modified HBI*	> 85%	70 - 85%	50 - 70%	< 50%
3.	Modified BCI**	> 85%	70 - 85%	50 - 70%	< 50%
4.	Scrapers/Filt. Collec.*	> 50%	35 - 50%	20 - 35%	< 20%
5.	Shredders/Others*	> 50%	35 - 50%	20 - 35%	< 20%
6.	EPT/Chironomids*	> 75%	50 - 75%	25 - 50%	< 25%
7.	EPT Index*	> 90%	80 - 90%	70 - 80%	< 70%
8.	% Contrib. Dom. Taxon**	< 20%	20 - 30%	30 - 40%	> 40%
9.	Dam. Taxa in Common*	4 - 5	3	2	1
10.	Common Taxa Index*	> 70%	50 - 70%	30 - 50%	< 30%
11.	Community Loss Index*	< 0.5	0.5 - 1.5	1.5 - 4.0	> 4.0
12.	Missing EPT Genera*	1	2	4	>4

*Based on comparison to reference site.
**Independent of reference site.

Overall Bioassessment of Water Quality

Mean Biometric Score	**Impairment Status**
4.8 - 6.0	No impairment
3.0 - 4.7	Slight impairment
1.3 - 2.9	Moderate impairment
0.0 - 1.2	Severe impairment

IV. CURRENT STATUS

Thirty-seven sampling sites on the Grande Ronde River and 20 of its major tributaries were established during the summer, 1989 (Attachment A). Habitat evaluation was done on each site at the time of its establishment; this evaluation was repeated when the macroinvertebrates ware sampled in September at those sites (Upper Grande Ronde River) where significant changes in habitat quality had occurred.

From September 5-12, 1989 water physio-chemical parameters ware measured and macroinvertebrates were collected at 27 sample sites. Additionally some water physio-chemical data and macroinvertebrate samples ware collected at one sample site (GRMF-8) from August 9-21, 1989 to monitor changes related to the Tanner Fire run-off. The water and habitat data have been entered into a data base at La Grande Ranger District. The macroinvertebrate samples have been sent to Fred Mangum for identification. Once the invertebrate data have been received, the biometrics will be calculated, and the overall water quality assessment will be made for each sample site.

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ATTACHMENT A: SAMPLE SITE LOCATIONS

Stream Name	ID	Location
Beaver Creek	BEVM-1	T03S,R36E,S30:SEofSW. Just upstream of confluence with Grande Ronde River. No marker pole; private property.
Beaver Creek	BEVM-2	T05S,R37E,S05:NWofSW. 50-100 feet upstream of 4305-270 spur road bridge and upstream of locked watershed gate. No marker pole.
Beaver Creek	BEVM-3	T05S,R37E,S16:NWofSE. About 50 feet upstream of end of service road and upstream of dam and upper water intake location. No marker pole.
Burnt Corral Creek	BNTM-1	T04S,R35E,S08:NEofNW. Just upstream confluence with meadow Creek where latter comes adjacent to HWY 244 in Elkanah area. No marker pole; private property, owner lives nearby.
Catherine Creek -- North Fork	CATN-1	T05S,R41E,S13:SEofSW. 0.8 mi upstream on Road 7785 from confluence with South Fork and 0.45 mi upstream of USFS boundary sign. Marker pole is on opposite side of road from stream. May have to sample smaller and slower side channel.
Catherine Creek -- South Fork	CATS-l	T05S,R41E,S24:SWofNW. 0.5 mi upstream on Spur Road 7785-600 from confluence with North Fork. Marker pole is off road 25-30 feet and down an embankment. May have to sample the smaller and slower side channel closest to road.
Chicken Creek	CHKM-1	T06S,R35.5E,S10:NEofNE. Just downstream of confluence of Main and West Forks, south of junction between Roads 51 and 5175.
Clark Creek	CLKM-1	T01N,R40E,S32:SEofSE. Just downstream confluence of North and Middle Forks on County Road 56. No marker pole; private property.
Clear Creek	CLRM-1	T06S,R36E,S9:SWofSW. Just downstream confluence of Main and East Forks approximately 1 mi up Road 5135.
Dark Canyon Creek	DRKM-l	T03S,R35E,S25:NEofSW. Approximately 100 yards upstream of confluence with Meadow Creek where Dark Canyon Greek cuts back in close to 2100-410 spur road.
Dark Canyon Creek	DREM-2	T03S,R35E,S14:NWofSE. 0.35 upstream from cattle guard and 0.5 mi upstream from USFS boundary sign on 2100-410 spur road; at downstream end of large cattle exclosure (there is a smaller exclosure downstream). No marker pole.

Five Points Creek	FPTM-1	T02S,R37E,S30:SWofSW. 0.2 mi up service road adjacent to railroad signal and small silver building. This road branches off Road 3106 at bridge and Stays between creek and railroad; it is signed as the 990 spur road, but it is not the 990 road shown on the map and may be signed wrong.
Fly Creek	FLYM-1	T04S,R35E,S23:NEofNW. Northern most channel at mouth. Have to wade across Grande Ronde. No marker pole.
Fly Creek	FLYM-2	T05S,R35E,S20:NWofNE. Just inside USFS boundary fence downstream of Road 5155 bridge off 5155-400 spur road.
Grande Ronde	GRMF-0	T06S,R26E,S14:NWofSW. Approximately 100 yards upstream of where Road 5138 now ends at side drainage where Tanner Gulch Fire run-off came down.
Grande Ronde	GRMF-1	T06S,R36E,S15:NEofNE. Below run-off drainage; upstream of beaver dams. About 100 ft upstream of camp site which is 0.35 mi upstream of where Road 5138 crosses East Fork of Grande Ronde. Site is just above new log jam/dam in original channel that diverted water into new channel.
Grande Ronde	GRMF-2	T06S,R36E,S10:SWofSE. Between Tanner Gulch and East Fork. About 0.1 mi upstream of where Road 5138 crosses East Fork is a trail sign across from a gravel pit. Site is downhill from this sign.
Grande Ronde	GRMF-3	T06S,R36E,S9:NEofSE. In area of tailing piles but upstream of fish structures. Adjacent to Road 5125 35-40 ft upstream from where 5125-240 (according to sign; map says -140) spur road crosses river.
Grande Ronde	GRMF-4	T06S,R36E,S5:NWofNE. Downstream of fish structures before river leaves USFS land. 0.1 mi upstream on 5125-150 spur road into camping area. At most-upstream camp site at channel junction.
Grande Ronde	GRMF-5	T05S,R35E,S25:NEofNW. About 100 yards upstream of Road 5125 bridge over Grande Ronde in Vey Meadow downstream of confluence of Sheep Creek. Green marker pole.
Grande Ronde	GRMF-8	T03S,R36E,S12:NEofNE. 1.2 mi upstream of Hilgard bridge on Hwy 244 where river comes back right next to road.

Grande Ronde -- East Fork	GREF-1	T06S,R35E,S10:NEofSE. 0.2 mi up 5138-010 spur road adjacent to rough camp site upstream from where road turns away from creek.
Indian Greek	INDM-1	T02S,R40E,S03:SEofNW. About 50 ft upstream of Road 62 bridge. No pole marker.
Limber Jim Creek	LJMF-1	T05S,R36E,S29:SEofSW. 20-30 ft upstream from where Spur Road 5130-015 crosses Main Fork, just inside exclosure fence.
Limber Jim Creek	LJMF-2	T05S,R36E,S29:NEofNE. About 100 feet downstream of confluence of Main Fork and North Fork; inside exclosure fence. Access site from 5130 Road 0.1 mi downstream from jct with 5130-110 spur.
McCoy Creek	MCYM-1	T03S,R35E,S34:NWofNE. Inside cattle exclosure upstream from Road 2137 bridge. No sign pole; private land. About 1 mi upstream from mouth.
Meadow Creek	MDOM-0	T03S,R35E,S36:NEofNW. About 50 yards upstream from HWY 244 bridge and 20-30 ft downstream from fence. No marker pole; on private land.
Meadow Creek	MDOM-1	T03S,R35E,S25:NWofSW. Just upstream of confluence of Dark Canyon Creek. No sign pole; on private property.
Meadow Creek	MDOM-2	T03S,R35E,S34:SEofSE. Inside cattle exclosure fence upstream from Road 2137 bridge. No sign pole; on private property.
Meadow Creek	MDOM-3	T04S,R35E,S08:NEofNW. Just above confluence with Burnt Corral Creek as Meadow Creek approaches Hwy 244. Accessed from private property; owner lives in mobile home at site and has given access permission; should check-in each visit. No marker pole.
Meadow Creek	MDOM-4	T03S,R34E,S35:NEofNW. Inside cattle exclosure upstream of Road 2120 bridge before Meadow Creek exits Starkey Experimental Forest; inside OSU riparian site. One of McLemore's sites. No marker pole.
Meadow Creek	MDOM-5	T03.R33.5,S24:NEofNE. Above confluence of Waucup Creek before Meadow Creek enters Starkey Experimental Forest.
Rock Creek	ROKM-1	T03S,R37E,S06:NEofNE. 0.55 mi downstream on road along S side Grande Ronde; about 50 ft upstream of gate across road that goes up Rock Creek. No marker pole; on private property.

Sheep Creek	SHPM-1	T05S,R35E,S34:SEofNE. Just upstream from Road 51 bridge. No marker pole.
Sheep Creek	SHPM-2	T06S,R35E,S12:NWofNW. Just upstream from where stream exits cattle exclosure and USFS land. Marker pole is visible from end of 5160-090 spur.
Sheep Creek	SHPM-3	T06S,R35E,S23:NWofNE. About 100 ft downstream from exclosure fence crossing creek. Accessed through wire gate 1.5 mi up Road 5182 from its junction with Road 5160 and 0.1 mi up Road 5182 from origin of 650 spur. Marker pole is one of a pair also marked "B-9".
Spring Creek -- South Fork	SPSF-1	T03S,R36E,S05:SWofSE. At end of well-gravelled part of Spur Road 2100-680 right where it is blocked-off and where 685 spur originates. No sign pole.
Waucup Creek	WAUM-1	T03,R33.5,S24:NEofNE. Between Road 21 culvert and confluence with Meadow Creek. Waucup Creek splits upstream of culvert and is too small to sample there,

ATTACHMENT D: MACROINVERTEBRATE SAMPLING METHODS

A standard Surber sampler should be used for collecting macroinvertebrates in order to maintain consistency with already collected data; a D-shaped kicknet can also be used but will not provide the semi-quantitative data provided by the Surber sampler.

Three composite subsamples should be taken at each sample site, with the subsamples taken successively from downstream to upstream locations. At the first subsample location the Surber sampler should be positioned as flat against the substrate as possible with the water flowing straight across the one foot square sampling area and into the sample net, which it causes to extend downstream. The feet of the collector should be positioned along each side of the one square foot sampling frame, but far enough back to avoid adding debris or organisms to the sample.

After the sampler is in position, cobbles within the one square foot sampling frame should be picked up and examined. Caddisfly cases should be carefully removed with forceps and placed directly into the sample bottle. Other organisms can either be removed directly to the sample bottle or else washed into the net by gently rubbing the cobble surface with the hands while holding the cobble in the water at the mouth of the sample net. Once they have been washed-off the cobbles should be discarded to the side and behind the sampling frame. All the larger cobbles, bigger than about 5 cm diameter, should be treated in this manner.

Once the cobbles have been removed, a sturdy stick or other tool should be used to thoroughly stir the gravel and sand within the one square foot sampling frame to a depth of at least 10 cm. This dislodges burrowing organisms that are then swept into the net.

The Surber sampler then should be carefully picked up and moved upstream to the next subsample location. The above procedure should be repeated at the other subsample locations without emptying the net in between. The sampler can then be removed to the shore or vehicle for the rest of the procedure.

The sampling bag should be emptied carefully into a shallow pan (a cake pan works fine) containing about 2 cm of saturated salt solution. Then the net should be carefully examined and all organisms clinging to it should be removed with forceps directly to the sample bottle.

Once the net has been picked, the contents of the pan can be stirred gently. Large, soft-bodied organisms should be removed with forceps and placed in the sample bottle. Then the pan should be swirled gently to separate the organic material, whichshould float in the salt solution, from the inorganic material. The solution and floating material are then poured into a soil sieve placed in a second pan, The solution should be transferred back to the original pan and the swirling and pouring process repeated until all organic matter has been transferred to the sieve. The sieve can be dumped and washed into the empty pan and the material can then be poured and washed into the sample bottle. Any organisms remaining in the sieve or pan should be removed with forceps and placed in the sample bottle.

Finally, the inorganic sand and gravel remaining in the first pan should be examined for the presence of caddisfly cases. These should be removed with forceps and placed in the sample bottle. Alcohol should be added to the bottle as necessary to cover the entire sample and the bottle should be labeled with sample site, date, and collector. The net and pans should be thoroughly rinsed to remove debris and traces of the salt solution.

Materials and Equipment:

Surber sampler
9"x13" cake pans (2)
#60 soil sieve (250 micron mesh)
saturated salt solution (rock salt dissolved in warm water and cooled)
forceps with fine points
sample bottles initially containing a small quantity of 70% alcohol
70% alcohol in wash bottle
marking pen to label bottle

ATTACHMENT E: BIOMETRIC CALCULATIONS

The biometrics used for assessing water quality are calculated as follows:

1. Taxa Richness:
   a. For both the reference site(s) and the sample site, compute taxa richness as:

      # of taxa identified to species
      + # of taxa identified only to genus
      + # of taxa idenfified only to family
      = total # of distinct taxa

   b. Calculate percent of reference site as:

$$\frac{\text{taxa richness of sample site}}{\text{taxa richness of reference site(s)}} * 100$$

2. Modified Hilsenhoff Biotic Index (HBIm):
   a. Convert the tolerance quotients supplied by Magnum for each taxon (i) from Mangum's scale of 2-108 to Hilsenhoff's scale of O-10 by:

$$t_i = (TQ_i * 10)/108$$

   b. For both the reference site(s) and the sample site, compute HBI as:

$$HBIm = \frac{\text{sum of } (n_i * t_i)}{n}$$

   where: TQ_i = Mangum's tolerance quotient for taxon i
   t_i = converted tolerance quotient for taxon i
   n_i = number of individuals in taxon i in sample
   n = total number of individuals in sample

   c. Calculate the percent of reference site as done above for taxa richness.

3. Modified Biotic Condition Index (BCIm):
   a. Use the predicted community tolerance quotient (CTQ provided by Mangum (or calculate it using Winget & Mangum, 1979.)

   b. Ignore the values provided by Mangum for actual community tolerance quotient (CTQ_a), which is a raw score that ignores relative density, and for density community tolerance quotient (CTQ_d), which uses a log 10 conversion of relative density that has little effect for weighting the data in relation to relative density.

   c. Calculate the weighted community tolerance quotient (CTQ_w) as:

$$CTQ_w = \frac{\text{sum of } (n_i + TQ_i)}{n}$$

d. Calculate BCIm as:

$$BCIm = \frac{CTQ_p}{CTQ_w}$$

4. Ratio of Scrapers to Filtering Collectors:
   a. Use Merritt and Cummins (1984) to classify each taxon into the proper functional feeding group.

   b. Calculate the ratio of the number of scraper taxa to the number of filtering collector taxa for both the sample site and the reference site(s).

   c. Calculate the percent of reference site as done above for taxa richness.

5. Ratio of Shredders to Others:
   a Calculate the ratio of the number of shredder taxa to total number of taxa present in either the riffle sample or in a separate CPOM sample for both the sample site and the reference site(s).

   b. Calculate the percent of reference site as above for taxa richness.

6. Ratio of EPT Taxa to Chironomids:
   a. Calculate the ratio of the total number of Ephemeroptera, Plecoptera, and Trichoptera taxa to the number of Chironomidae taxa for both the sample site and the reference site(s).

   b. Calculate the percent of reference site as done above for taxa richness.

7. EPT Index:
   a. Use the total number of Ephemeroptera, Plecoptera, and Trichoptera taxa computed above.

   b. Calculate the percent of reference site as done above for taxa richness.

8. Percent Contribution of Dominant Taxon:
   a. Calculate the percent of the total number of individuals that belong to the most abundant taxon.

9. Dominant Taxa in Common (DTIC):

a. Determine the five must abundant taxa in both the sample site and the reference site(s); they will usually have relative abundances greater than 7%.

b. Determine the number of these abundant taxa in common to both the sample site and the reference site(s) regardless of order of relative abundance.

10. Common Taxa Index (CTI):

a. Determine the total number of taxa present at the sample site (N_s) and at the reference site(s) (N_r).

b. Determine the number of these taxa present at both sites (TIC).

c. Calculate the Common Taxa Index as:

$$CTI = \frac{TIC}{N_s \text{ or } N_r\text{, whichever is larger,}}$$

11. Community Loss Index (CLI):

a. Use the values determined in 10 above to calculate the Community Loss Index as:

$$CLI = \frac{N_r - TIC}{N_s}$$

12. Missing EPT Genera:

a. Determine which of the Ephemeroptera, Plecoptera, and Trichoptera genera that are present at relative abundance of greater than 4% in the reference site(s) are absent from the sample site.

APPENDIX III

Tanner Gulch Fire Rehabilitation

Accomplishment Report

1989

Prepared by

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February 14,1990

The Tanner Gulch Fire, located in the upper Grande Ronde River watershed, burned approximately 4,700 acres from July 26, 1989 to August 8, 1989. Approximately 3,400 acres were burned on the La Grande Ranger District, of which 1,800 acres ware in the high intensity burn condition. The terrain in the burn area is steep with slopes ranging from 35 to 90%. The principle geologic types in the area are granitics and granodiorites. Soils range in depth from 7 to 20 inches. Aspect is west facing on the Grande Ronde River drainages and north-northwest facing on the East Fork Grande Ronde River drainages. Elevation ranges from 5,500 to 6,900 feet.

On August 8, 1989, approximately 1.25 inches of precipitation fell on the burn area. The intensity of the storm event and the burned area appear to have combined to produce sheet flow, causing a flash flood in the upper Grande Ronde River. The flood water carried ash, sediment, and burned debris into the tributary channels and downstream to the Grande Ronde River to La Grande, Oregon by August 10. Immediate effects on aquatic habitats and hillslopes were experienced, along with immediate effects on aquatic life.

Given the environmental conditions, supplemental rehabilitation measures were immediately needed to minimally maintain the emergency rehabilitation objectives. This report details the impacts to the hillslopes and downstream areas of the Grande Ronde River watershed, documents the fisheries losses and describes the rehabilitation measures and monitoring plan.

Description of Affected Area and Resources

The Grande Ronde River produces spring chinook salmon, summer steelhead trout, resident rainbow trout, brook trout, and potentially red band trout and bull trout. It also produces mountain whitefish, suckers, squawfish, date, redside shiners, and crayfish. The Grande Ronde River above Sheep Creek produces the majority of anadromous salmonids in the upper Grande Ronde River. This area has the highest quality spawning and rearing habitat for anadromous and resident salmonids in the upper watershed. The area of the main stem Grande Ronde River below Sheep Creek has limited spawning and rearing capabilities relative to the area above Sheep Creek.

The La Grande Ranger District has implemented over $150,000 of Bonneville Power Administration funded stream enhancement structures in the upper Grande Ronde River. These structures are located from the East Fork Grande Ronde River to just below Woodley Campground, Implementation started in 1986 and is ongoing.

The Oregon Department of Fish and Wildlife (ODFW) releases legal size rainbow trout in the upper Grande Ronde River for recreational anglers. The ODFW also releases steelhead trout and chinook salmon smotls in the upper Grande Ronde River as part of the Lower Snake Compensation Plan. No smolts were released this year.

The Confederated Tribes of the Umatilla Indian Reservation (The Tribes) have usual and accustomed fishing grounds located in the upper Grande Ronde River in the area of fire/flood damage. As such, the upper Grande Ronde River is culturally significant.

Adult spring chinook salmon hold in the upper Grande Ronde River from about the end of July and spawn about the end of August. A low run year (1989) was experienced for returning spring chinook salmon (pers. comm. ODFW). The Tribes were asked to suspend fishing on the upper Grande Ronde River due to the low returns. The Tribes complied with the request. Adult summer steelhead trout spawn in the upper Grande Ronde River from about the middle of April to the first of July. Juvenile spring chinook salmon and summer stealhead trout utilize the upper Grande Ronde River for rearing throughout the entire year.

Prior to the fire/flood event, the area of the upper Grande Ronde River above Tanner Gulch provided reasonably high quality water to downstream areas. The erosion potential for the burned area was determined as 3258 cu. yd/sq. mi. by the Forest Soil Scientist. This represents a significant amount of potential sedimentation to the Grande Ronde River.

Assessment of Affected Watershed and Fisheries Resources

The combination of fire and intense rain contributed to a catastrophic event in the Grande Ronde River watershed. Sheet flow, originating at the ridgelines, carried ash and small burned material off the slopes and into the stream channels, Several tributaries, originating in high intensity burn areas, experienced debris torrents. These tributaries contributed the majority of ash, sediment, and debris to the Grande Ronde River. The tributaries downcut to bedrock and have a number of large debris jams at areas of topographical relief. These debris jams have trapped only a limited amount of sediment.

Hillslopes in the high intensity burn areas experienced no rilling or gullying. Down woody material on the slopes was, for the most part, elevated off of the ground and was not effective in slowing ash and sediment transport. In the moderate and low intensity burn areas, ash, sediment, and debris were slowed by remaining ground vegetation and debris. No fine organic matter remains on the slopes in the high intensity burn areas. Bare soil is now exposed on most of these slopes. The exposed soil has developed a crust which appears to be somewhat impervious to moisture.

Ash and sediment which came off the slopes and washed into the Grande Ronde River and East Fork Grande Ronde River was carried downstream as far as La Grande, Oregon, Water quality data taken on August 9 and August 10, 1989 indicate a drop in dissolved oxygen levels to below lethal limits for salmonids. Alkalinity, turbidity, and conductivity were also elevated. Turbidity increased from 4 FTU's (Formazin Turbidity Units) to 170 FTU's in a two hour period at the Hilgard data station located one mile above Hilgard State Park (Table 1).

Damage to the fisheries'resources of the upper Grande Ronde River was significant. A total of 41 adult spring chinook salmon were found dead along approximately 20 miles of impacted river. Because salmonids are easily stressed when on the spawning grounds, an event such as this (with high turbidity, low dissolved oxygen, and the stressed condition of the fish) is not conducive to survival.

It is estimated that this event eliminated 100% of the 1989 adult spring chinook salmon run in the upper Grande Ronde River (Table 2). It is also estimated that the event eliminated 100% of the 1988 brood production (Age 0). It is estimated that 50% of the steelhead trout smolt production expected from the upper Grande Ronde River was lost due to the fire/flood event (Table 3).

Documentation of Impacts of the Aquatic Environment

The following is a chronology of events as documented by La Grande Ranger District Fisheries personnel:

August 8, 1989

At approximately 1800 hours a District engine crew containing a District fisheries personnel was dispatched to the upper Grande Ronde River to investigate the report of a flash flood. At the mouth of Sheep Creek, personnel saw a rise in river water level that proceeded downstream as a minor flood. The river rose approximately 1.5 to 2.0 feet over a 30 second to 1 minute interval. The water was dark brown and carried a heavy sediment load. The personnel stayed ahead of the flood and sediment load, monitoring its movement downstream to Sherwood Campground, The movement downstream was approximately 0.1 miles in 10 minutes.

August 9, 1989

District fisheries personnel estimated the flood flow crested at 2.5 feet above existing flows at Woodley Campground, The water was dark brown with a heavy smell of ash. Black, fine sediment was deposited along the banks in the campground area. Dead juvenile steelhead trout, brook trout, and whitefish were deposited at the high water mark indicating mortality occurred in the early stages of the flood. At 0.5 miles above Woodley Campground three (3) dead adult spring chinook salmon were found. The salmon carcasses were found at the high water mark and were estimated to have been killed within the previous 15 hours. The gills were completely covered with the fine cohesive sediment.

The East Fork Grande Ronde River was dark brown in color and exhibited a high water mark with fine dark sediment deposited on the banks and over the flood plain. Limber Jim Creek showed no evidence of flooding or sedimentation.

Water quality parameters were sampled with a Hach kit, model Drel/5, approximately 1.0 miles above Hilgard State Park at 1415 and 1615 hours. The following data was recorded:

	1415 hrs	1615 hrs
PH	8.8	8.1
temp (c)	24.6	27.0
Alk (mg/1)	40.0	77.0
conduct (moho)	90.0	350.0
turb (FTU)	4.0	170.0
DO (mg/1)	7.6	4.8

The data taken at 1415 hours was in advance of the sediment plume. The data taken at I.615 hours was after the plume had advanced downstream past the data station. Subsequent water quality data was taken at later dates (Table 1).

August 10, 1989

The Grande Ronde River at La Grande, Oregon was dark brown and sedimentation was becoming noticeable, No fish mortality was noted at this site. Upstream at Perry, deposition of sediment was about 3 inches. Two **(2)** dead juvenile steelhead trout were found at this site. Dead whitefish, suckers and dace were found from Hilgard State Park upstream in numbers ranging from few to moderate. Dead juvenile steelhead trout and chinook salmon juveniles were found in low numbers from Hilgard State Park upstream.

The tributary which enters the Grande Ronde River in section 14 (map 1 or 2) below Tanner Gulch was surveyed. This tributary sluiced out from its' headwaters to the Grande Ronde River. The high water mark was approximately 15 feet above the existing channel. Approximately 80% of the channel length was sluiced out to bedrock. There are numerous log jams and rock cataracts in the channel which appear to have formed as a result of the fire/flood event. This tributary appears to have contributed the majority of the ash/sediment as well as water to the Grande Ronde River, The East Fork Grande Ronde River had cleared substantially.

August 14, 1989

The East Fork Grande Ronde River returned to near normal clarity, enabling District fisheries personnel to sample for juvenile salmonids. Steelhead trout juveniles, brook trout, and bull trout were found in low numbers. Sampling took place in the lower 0.25 miles using an electrofishing unit. Both age 0 and 1+ steelhead trout ware found.

August 14 & 15, 1989

The upper basin tributaries of the East Fork Grande Ronde River were surveyed. The third order tributary which enters the East Fork at section 12 (map 1 or 2) sluiced out and deposited ash and sediment, The other tributaries appeared to have remained stable. Overland flow was evident on the slopes. No distinct rilling or gullying was apparent, **A** similar situation was found in the burn area on the slopes of the tributaries to the Grande Ronde River. The Grande Ronde River above the sluiced out tributary (Sec 14) was clear with only a minimal amount of ash and sediment found in the pools and point bars. Water quality appeared to be largely unaffected.

August 16, 1989

District fisheries personnel, Forest Fisheries Biologist, and a Research Fish Biologist from Oregon Department of Fish and Wildlife conducted a complete walk through of the Grande Ronde River from the mouth of Meadow Creek, just below Starkey, Oregon to the sluiced out tributary (Sec 14). A total of 41 dead adult spring chinook salmon ware found. The majority (39) were found from the mouth of Sheep Creek upstream. Only one chinook salmon had spawned. Juvenile steelhead trout, both age 0 and 1+, were seen alive and swimming in the surveyed reach. The spawning gravel appeared to be covered and filled in with the ash/sediment residue.

Sheep Creek was surveyed for live adult spring chinook salmon from the mouth upstream approximately 2.0 miles. No adults were found.

August 17, 1989

District fisheries personnel surveyed approximately 1.0 miles of the Grande Ronde River upstream from the sluiced out tributary (Sec 14). As the surveyors proceeded upstream some ash/sediment residue was observed. This amount was not significant in relation to that found below the tributary.

Emergency Rehabilitation Project

Erosion control seeding was prescribed by the rehabilitation team immediately following containment of the fire and implemented the first of September 1989. Aerial seeding of a grass/legume (both perennial and annual species) mix was conducted on all significant blocks of high intensity burn on all slope classes. Areas of moderate burn intensity were seeded where they occurred on slopes greater than 40% and/or ware intermingled with large blocks of high intensity bum. The mix included: orchardgrass, timothy, yellow blossom sweetclover, white dutch clover and winter wheat.

Riparian areas in the high intensity burn ware seeded by a double pass to cover the area approximately 60 feet either side of the riparian area for the purpose of creating a densely vegetated toe slope buffer strip. The vegetation created in the buffer strip is designed to trap sediments before they enter the stream channel.

Supplemental Rehabilitation Project

Implementation

Funding was obtained for approximately one half of the proposed treatment. Because of the reduced funding level, three high priority drainage areas were selected for treatment based on streamflow and potential sediment delivery to the Grande Ronde River (map 1 and 2). Two drainages consisted of individual streams that joined below the burn prior to entering the Grande Ronde River (Sec 13 and 23). The third drainage area contained three tributaries that joined within the burn area, entered the East Fork Grande Ronde River, then joined the Main Fork Grande Ronde River below the burn (Sec 7,12 and 13).

Each drainage area originated near the ridgeline of the Grande Ronde River watershed at approximately 6800ft elevation and subsequently flowed through the burn to the Main Fork Grande Ronde River at 5100ft elevation. Each drainage contained areas of high intensity burn with slope gradients in excess of 65%. The treatment scheme for each basin consisted of directional contour felling dead trees on slopes with high erosion potential and installing instream sediment traps.

Approximately 4.2 miles of contour lines were constructed throughout the three drainages using directional tree felling and bucking (map 1). Trees were fell across the slope in an interlocking line 3-10ft wide. Bucking was utilized to ensure that 80% of the bole was in contact with the ground. Contour lines were vertically spaced approximately every 100ft of elevation starting at the upper end of each treatment area and proceeding downslope. The height of each contour line was a minimum of one foot.

A two day helitac operation was utilized to transport straw bales to contour line and sediment trap locations. The bales were hand placed at specific locations and distributed. Straw was distributed along selected contour lines for additional sediment filtration. One bale covered a linear length of 15-20 feet,

Sediment traps were installed in the downcut tributaries for sediment abatement and storage (map 2). The sediment traps consist of man-made large woody debris jams spanning the stream channel at bankfull width. In areas of extreme channel downcutting, whole straw bales were placed up stream from the debris jam to facilitate sediment storage. Boulders and small woody debris was utilized in the same manner where available.

Photo point monitoring stations were established throughout the project area at specified sediment trap and contour line locations. Monitoring stations ware staked with a carsonite sign. 'Photos were taken from the each site in a recorded compass direction.

Accomplishments

On October 5, 1989 the implementation of the supplemental rehabilitation project was completed. A total of 19 contour lines were constructed for a linear total of 22,029 feet covering a total area of 260 acres. A total of 26 instream straw sediment traps and 38 instream woody debris jams were constructed for sediment storage in three drainages. A total of 52 photo point monitoring stations were established in the treatment area. The Union and LaGrande Interagency Hotshot Crews provided much of the labor needed to complete the project,

The completed contour felling and sediment trap construction is estimated to reduce sediment yield by 36%. This was determined based on the erosion rate and estimated sediment storage capabilities of the contour lines and sediment traps. The project was completed for a cost of $29,381.

TABLE 1 - Water quality parameters taken on the Grande Ronde River in response to the Tanner Gulch Fire, August 1989.

Site	Parameter	8/9 (1415)	8/9 (1615)	8/10	8/14	8/21	8/22	8/23
Hilgard	PH	a.8	8.1	a.2	9.2	9.4	9.0	a.4
	Temp(C)	24.6	27.0	19.4	21.3	23.1	17.7	14.6
	Alk(mg/1)	40.0	77.0	78.0	68.0	57.0	54.0	51.0
	Cond(moho)	90.0	350.0	177.0	172.0	124.0	160.0	95.0
	Turb(FTU)	4.0	170.0	55.0	15.0	6.0	6.0	20.0
	DO (mg/1)	7.6	4.8	6.8	a.7	7.5	8.1	7.0
Starkey	pH			a.35	8.8	9.1	8.6	8.3
	Temp			21.5	22.9	21.3	17.0	13.6
	Alk			75.0	53.0	50.0	52.0	51.0
	Cond			210.0	116.0	117.0	150.0	109.0
	Turb			70.0	18.0	6.0	6.0	125.0
	DO			7.3	8.1	7.1	7.5	a.3
Vey Mdws	pH			8.5	8.6	8.8		8.3
	Temp			21.5	16.5	17.5		11.5
	Alk			45.0	47.0	46.0		43.0
	Cond			172.0	100.0	109.0		90.0
	Turb			40.0	35.0	7.0		22.0
	DO			7.3	a.5	8.4		a.3
Tailings	pH			a.2	a.2	8.6		a.5
	Temp			17.5	14.1	13.8		9.4
	Alk			51.0	41.0	43.0		39.0
	Cond			157.0	127.0	93.0		95.0
	Turb			75.0	47.0	9.0		55.0
	DO			7.9	8.4	a.7		a.9
DP #8	pH			a.3	8.6	a.4		8.6
	Temp			15.3	10.9	11.8		a.7
	Alk			47.0	42.0	33.0		52.0
	Cond			175.0	300.0	240.0		125.0
	Turb			70.0	30.0	20.0		205.0
	DO			7.7	8.2	a.5		a.8
East Frk	pH			a.5	8.3	8.1		a.4
	Temp			17.3	10.9	12.8		9.2
	Alk			81.0	75.0	59.0		66.0
	Cond			1150.0	175.0	145.0		154.0
	Turb			19.0	22.0	5.0		42.0
	DO			7.8	a.5	a.5		8.4
Clear Cr	pH			a.2	8.3	8.3		a.4
	Temp			14.8	14.4	12.1		9.6
	Alk			31.0	30.0	33.0		32.0
	Cond			65.0	65.0	105.0		68.0
	Turb			10.0	15.0	1.0		2.0
	DO			a.3	8.8	a.5		9.0

Table 2 - Estimated Loss of Spring Chinol Salmon from the Tanner Gulch Fire/Flood Event of August 8, 1989.

Assume complete loss of 1988 brood production (Age 0).

1988 Adult count : 98 adults per 8.5 miles - 11.5 adults/mile.
1988 Redd count : 99 redds per 8.5 miles = 11.6 redds/mile.
141 Redds = 70% of spawning in index area for upper basin.

Egg deposition :	3,940 eggs/redd x 141 redds	555,540 eggs
Egg to smolt survival:	555,540 eggs x 10% survival	55,554 smolts
Potential Adults:	555,554 smolts x 0.4% (smolt to adult survival)	222 adults

1988 Economic loss : $550/adult spring chinook x 222 adults 1/	$122,000
Adjustment for inflation, 1982-1989 : 10%	$134,000
1989 Economic loss : $550/adult spring chinook x 41 adults	$25,000
Total loss 1988 and 1989 spring chinook salmon	$159,000

1/ Meyer, P.E. 1982. Net economic values for salmon and steelhead from the Columbia river system, NOAA Technical Memorandum NMFS F/NWR-3.

TABLE 3 - Estimated Loss of Summer Steelhead Trout from the Tanner Gulch Fire/Flood Event of August 8, 1989.

Production area: Grande Ronde River, Hilgard to E.F. Grande Ronde = 36 miles
Redds: 5 year average, 1985-1989, upper Grande Ronde River = 3.8 redds/mi

Total redds	3.8 redds/mi x 36 mi	136.8	redds
Adults	136.8 redds x 1.67 adults/redds	228.0	adults
Egg Deposition	5,000 eggs/redd x 136.8 redds	684,000.0	eggs
Egg to Smolt	684,000 eggs x 15% (egg to smolt survival)	102,600.0	smolts
Smolt to Adult	102,600 smolt x 0.5% (smolt to adult survival)	513.0	adults

Assume 50% loss of smolt production, results in a loss of 256 potential adults

Economic loss : $359/spawning summer steelhead x 256 adults 1/	$ 92,000
Adjustment for inflation 1982 to 1989 : 10%	$100,000
Total loss of summer steelhead trout	$100,000
Rainbow trout (resident), 10,000 planted, estimate 3000-4000 loss	$ 6,000

1/ Meyer, P.E. 1982. Net economic values for salmon and steelhead from the Columbia river system. NOAA Technical Memorandum NMFS F/NWR-3.

APPENDIX IV

TECHNIQUES TO ACCELERATE RECOVERY OF STEELHEAD TROUT HABITAT FOLLOWING GRAZING AND LOGGING IN MEADOW CREEK, OREGON

OBJECTIVE:

1) Document changes in woody riparian vegetation and stream channel dynamics resulting from several treatment regimens in middle Meadow Creek basin.

2) Document changes in fish habitat (riffles, pools, glides, substrate, cover) and fish community structure (salmonids and non-salmonids) resulting from several treatment regimes in middle Meadow Creek basin.

3) Document changes in summer and winter water temperatures resulting from several treatment regimes in middle Meadow Creek basin.

DESIGN:

The middle reach of Meadow Creek on Starkey Experimental Forest will be divided into 4 approximately one mile segments, starting at the downstream boundary of Starkey Experimental Forest and progressing upstream. Divisions will coincide with previous study sections defined as Phase I, II, III, and IV.

<u>Phase I</u> is a one mile reach with a primarily timbered narrow floodplain. Riparian vegetation consists of true fir, yellow pine, larch, some scattered spruce at the upstream end, and willow and alder, The area was subjected to streamside timber harvest in the 1950's and earlier, and has been variably subjected to season-long livestock grazing for the past 6 to 10 years.

<u>Treatment:</u> The riparian area currently is fenced to control movements of livestock, but not movements of big game. Treatment in this area will exclude livestock use in the riparian zone beginning in 1990, but allow free access of deer and elk. Habitat treatment in the upper half of the reach will consist of protection of riparian vegetation from livestock use only. Riparian vegetation will also be protected from livestock use in the lower half of the reach, and pool habitat will be increased to 20 high quality pools (<3 feet deep with wood and boulder cover) par mile,

Phase II is a 1.25 mile reach with a wide floodplain dominated by dry meadows. Riparian vegetation consists of grasses and forbs with scattered alder, willow, and conifers. The area has received a variety of grazing treatments in the last 10 years, including a non-grazed control, two rest rotation pastures, a deferred rotation pasture, and a season long pasture.

Treatment: Sections 2, 3, and 4 of this reach will be fenced with a game and livestock-proof fence. High quality pools at the rate of 20 per mile will be added to the upper half of the fenced section. The lower half will receive no pool development. Riparian vegetation in the entire fenced area will be allowed to grow naturally without the influence of grazing animals. Section 5 of Phase II (ungrazed since 1975) will also receive a treatment of pool development. Section 1 of Phase II will receive season-long livestock grazing and no pool development,

Phase III is a one mile reach beginning at the concrete bridge over Meadow Creek on the Starkey Experimental Forest and extending upstream. The riparian area is enclosed by a game-proof fence. The enclosure is divided into 5 sections, each. about 0.2 miles in length. The downstream section has been ungrazed since 1975, and the upper 4 sections have each been subjected to various livestock grazing treatments. Riparian vegetation consists of grasses, forbs, alder, willow, and conifers.

Treatment: Section 5, the ungrazed control, will remain in ungrazed status and will receive no pool development work in the channel. Sections 3 and 4 will continue to receive livestock use (rest rotation in 4 and deferred rotation in 3) with no pool development work in the channel. Sections 1 and 2 will continue to receive livestock use (season-long in 2, and rest rotation in 1) and both will subjected to pool development at a rate of 20 high quality pools per mile.

Phase IV is a one mile reach beginning at the downstream Starkey Experimental Forest boundary and extending 'upstream to the first concrete road bridge over Meadow Creek. The area has been exposed to both game use and short duration high intensity livestock use for the last decade, and timber in the riparian zone was intensively harvested historically. The riparian community consists of conifers, willow, alder, and forage plants. The flood plain is narrow through most of the reach.

Treatment: The downstream half of the reach will continue to be grazed by game and livestock and will undergo pool development at a rate of about 20 pools per mile. The upstream half of the section will continue to be grazed, but no pool development is planned for the area.

Summary of Treatments:

1) No livestock, no game, no pool development (Phase II, 0.4 mi.)(new enclosure).

2) No livestock, no game, pool development (Phase II, 0.4 mi.)(new enclosure)

3) Livestock, no game, no pool development (Phase III, 0.4 mi.)(existing game fence),

4) Livestock, no game, pool development (Phase III, 0.4 mi.)(existing game fence),

5) No livestock, game, no pool development (Phase I, 0.5 mi.)(existing stock fence).

6) No livestock, game, pool development (Phase I, 0.5 mi.)(existing stock fence).

7) Livestock, game, no pool development (Phase IV, 0.5 mi.)

8) Livestock, game, pool development (Phase IV, 0.5 mi.)

9) Livestock, game, no pool development (Phase II, 0.25 mi.)(section to allow upland cows access to water),

10) No livestock, no game, no pool development, with 14 years protection of riparian vegetation (Phase III, 5, 0.25 mi.)

APPENDIX V

AERIAL PHOTO OVERLAYS OF LOCATION AND TYPES OF IMPROVEMENT STRUCTURES

Joseph Creek Subbasin
Devil's Run Creek
and
Chesnimnus Creek · Segment E

Boulders

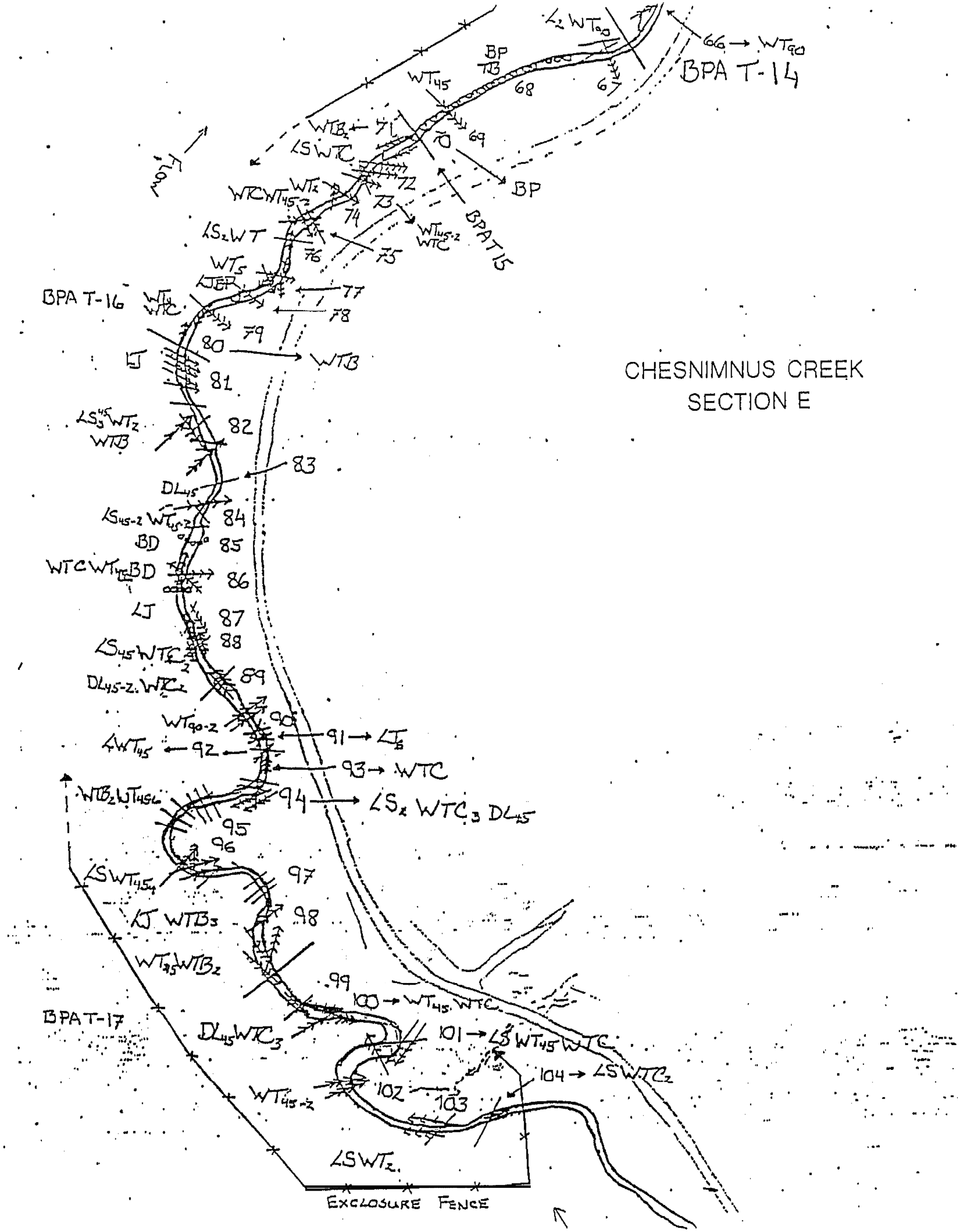
BP	Boulders placed
BPB	Bank protection boulders
TB	Turning boulders
BD	Boulder dam

Whole Trees

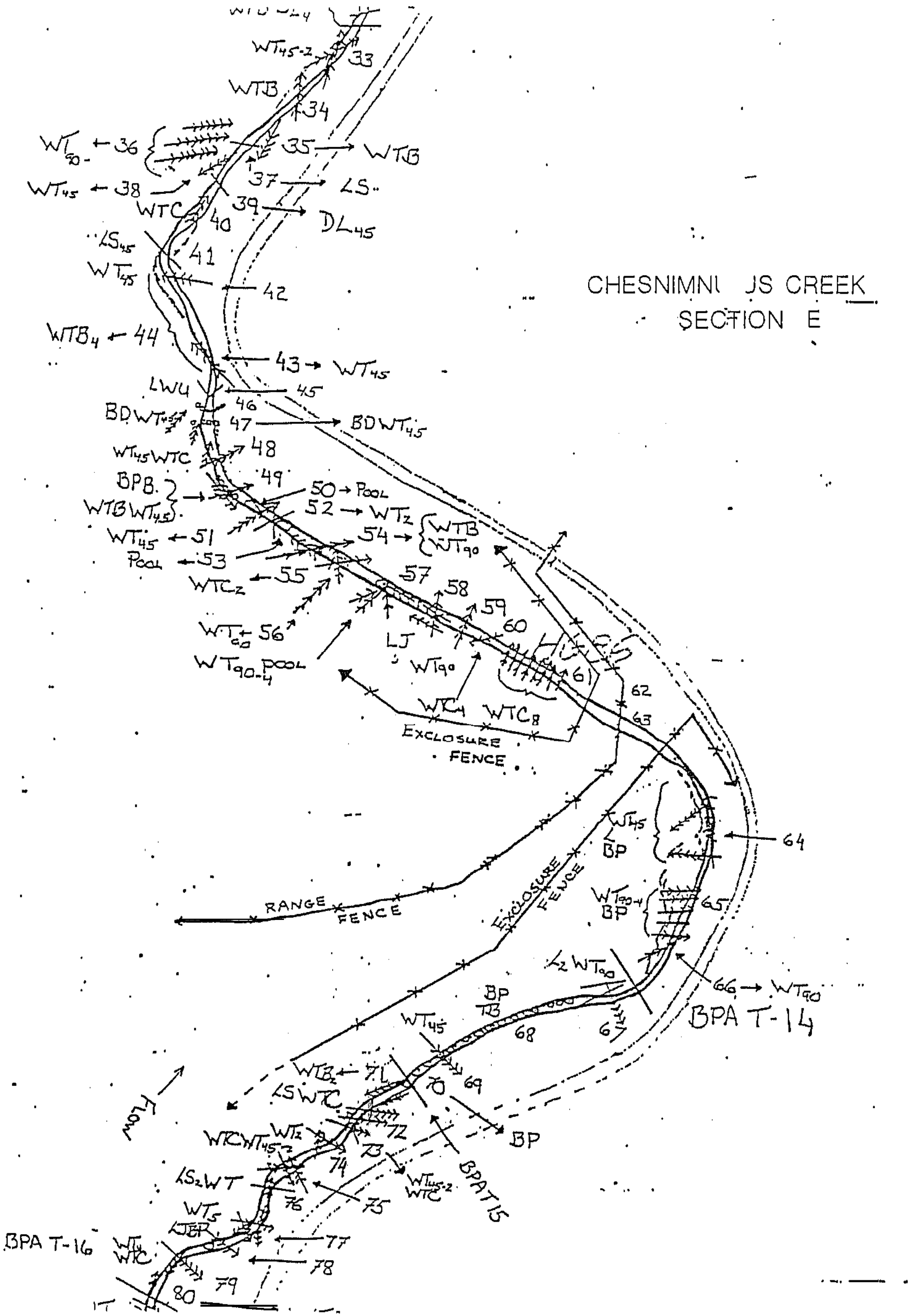
WT_{45}	Whole tree placed at 45° to channel
WT_{90}	Whole tree placed at 90° to channel
RW	Root wad
WTC	Whole tree cover
WTB	Whole tree bank protection

Logs

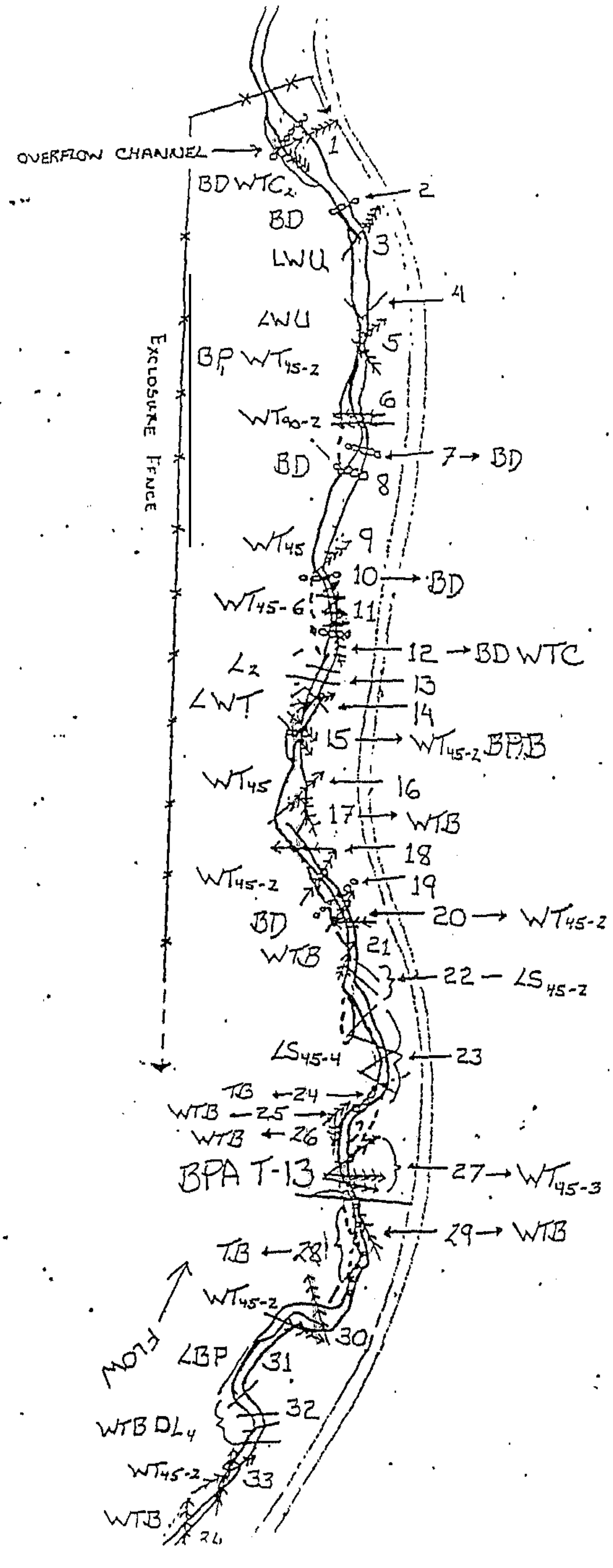
LS	Log sill
LS_{45}	Log sill placed at 45° to channel
L_{45}	Log across creek at 45°
L	Log across creek
LWU	Log weir, upstream "vee"
LWD	Log weir, downstream "vee"
LBP	Log bank protection
LJ	Log jam
DL_{45}	Digger log placed at 45° to channel


CHESNIMNUS CREEK
SECTION E
BPA T-14
BPA T15
BPA T-16
BPA T-17
Flow
EXCLOSURE FENCE
66 → WT90
100 → WT45 WTC
101 → LS WT45 WTC
104 → LS WTC2
94 → LS2 WTC3 DL45
93 → WTC
91 → LJ
80 → WTB

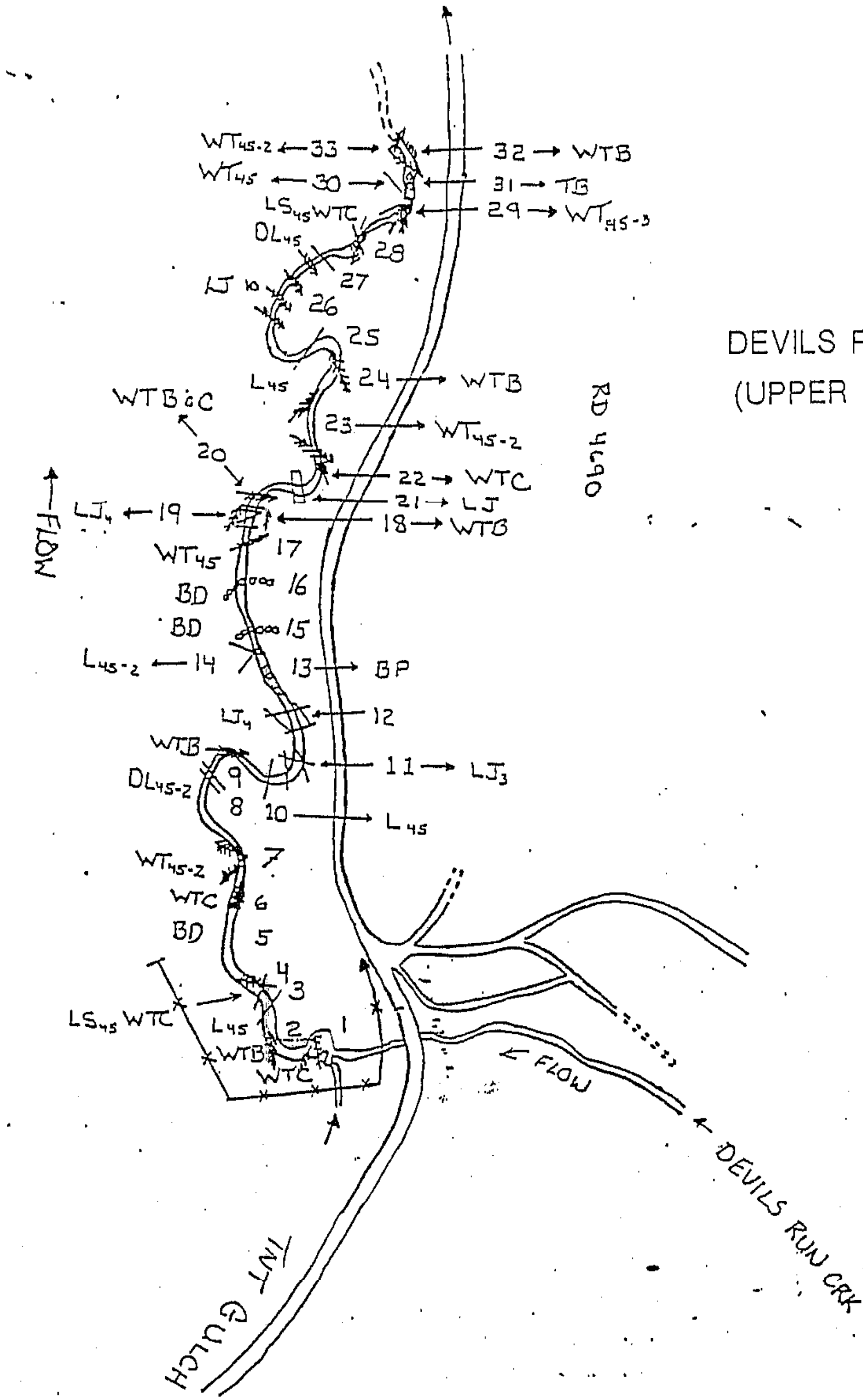
CHESNIMNU[illegible] JS CREEK
SECTION E

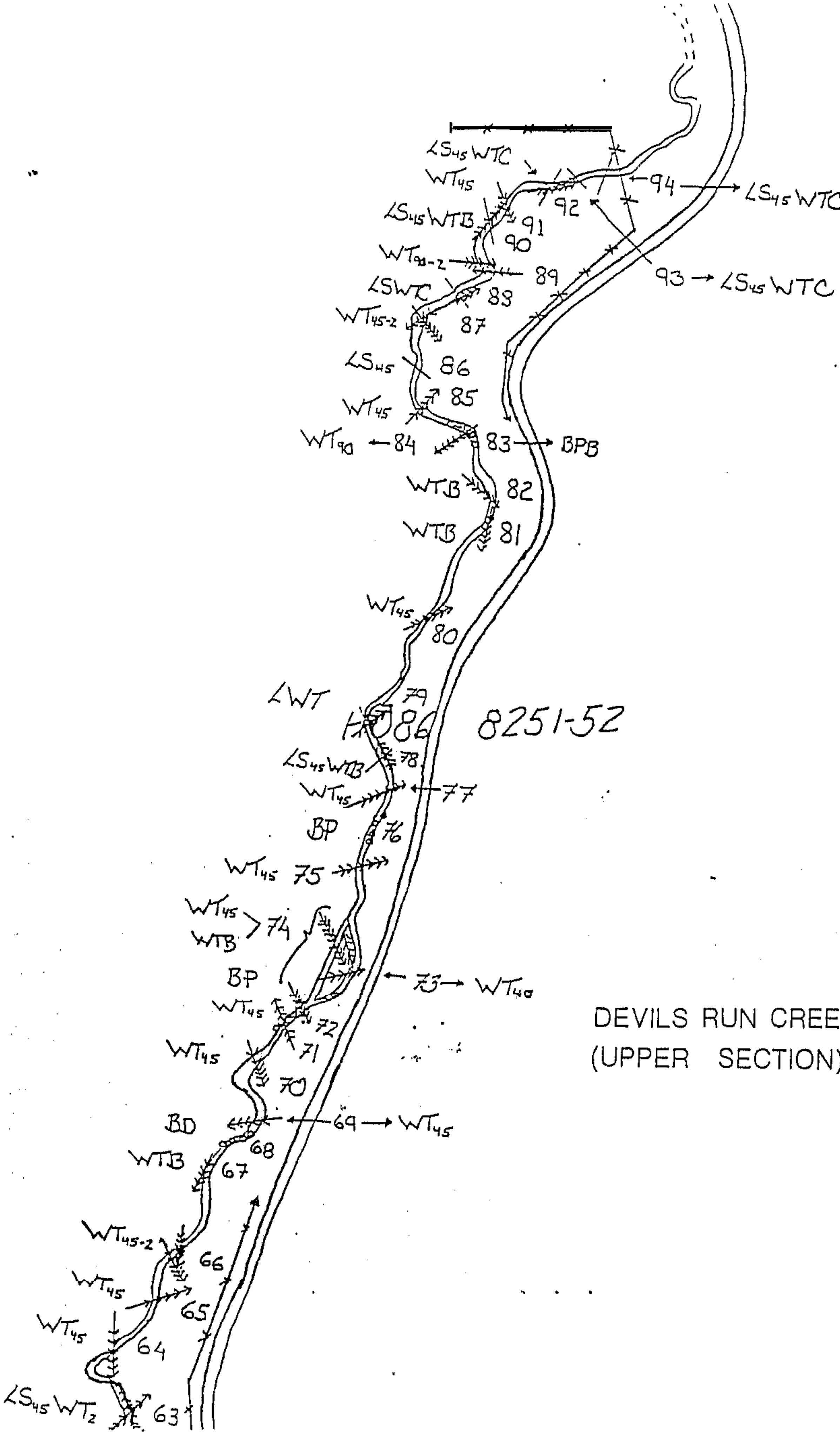


CHESNIMNUS CREEK
SECTION E

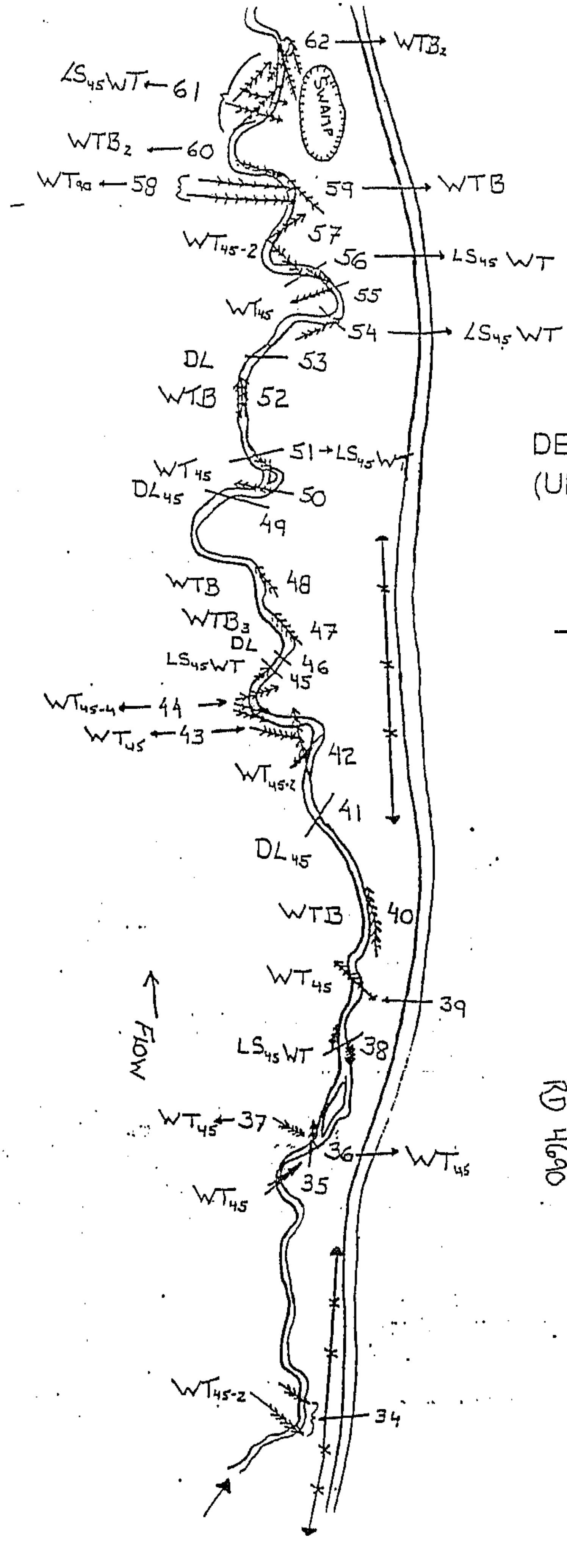


DEVILS RUN CREEK
(UPPER SECTION)

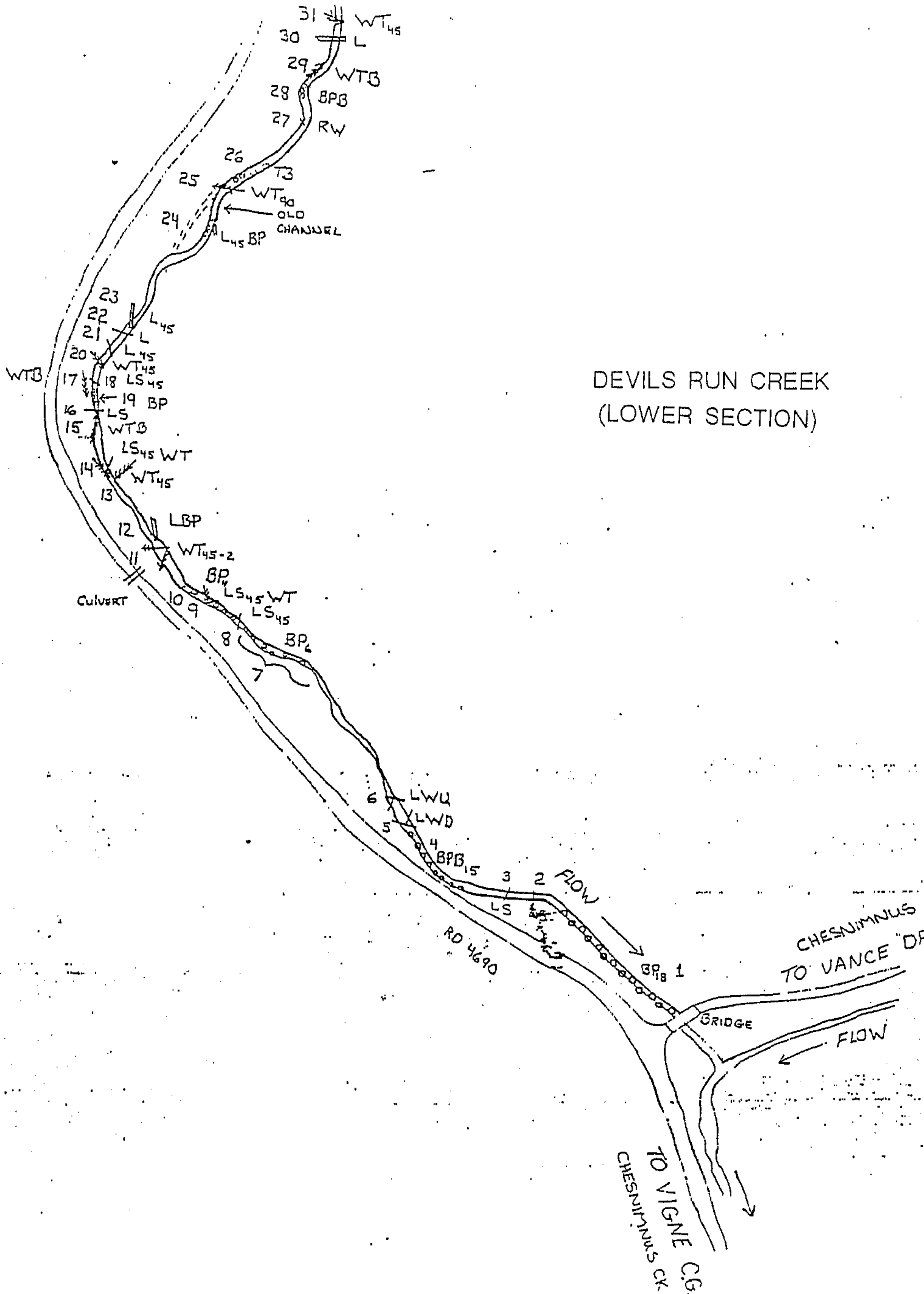




DEVILS RUN CREEK
(UPPER SECTION)



DEVILS RUN CREEK
(UPPER SECTION)



DEVILS RUN CREEK
(LOWER SECTION)
31 WT45
30 L
29 WTB
28 BPB
27 RW
26
25 T3
WT90
OLD CHANNEL
24 L45 BP
23
22 L45
21 L
L45
20 WT45
WTB
17 18 LS45
19 BP
16 LS
15 WTB
LS45 WT
14 WT45
13
12 LBP
WT45-2
11
CULVERT
10 9
BP4 LS45 WT
LS45
8 BP6
7
6 LWU
5 LWD
4 BPB15
3 2
LS
FLOW
RD 4690
BP18 1
BRIDGE
CHESNIMNUS
TO VANCE DR
FLOW
TO VIGNE C.G.
CHESNIMNUS CK.

APPENDIX VI

Joseph Creek Subbasin Summary of Improvement Structures FY89

SUMMARY OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

Devil's Run Creek (Lower Section)

Structure Number	Structure Type																	
	BP	BPB	TB	BD	WT_{45}	WT_{90}	WTC	WTB	LS	LS_{45}	L	L_{45}	LWU	LWD	LBP	LJ	DL_{45}	RW
1	X																	
2										X								
3										X								
4		X																
5														X				
6													X					
7	X																	
8											X							
9						X					X							
10	X																	
11					X													
12															X			
13					X													
14								X		X								
15								X										
16									X									
17								X										
18										X								
19	X																	
20					X													
21												X						
22											X							
23												X						
24	X											X						
25						X												
26			X															
27																		X
28		X																
29								X										
30											X							
31					X													
TOTALS	5	2	1		4	2		4	1	4	4	3	1	1	1			1

SUMMARY OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

Devil's Run Creek (Upper Section)

Structure Number	BP	BPB	TB	BD	WT_{45}	WT_{90}	WTC	WTB	LS	LS_{45}	L	L_{45}	LWU	LWD	LBP	LJ	DL_{45}	RW
	Structure Type																	
1							X											
2								X										
3												X						
4							X			X								
5				X														
6							X											
7					X													
8																	X	
9								X										
10												X						
11																X		
12																X		
13	X																	
14												X						
15				X														
16				X														
17					X													
18								X										
19																X		
20							X	X										
21																X		
22							X											
23					X													
24								X										
25												X						
26																X		
27																	X	
28							X			X								
29					X													
30					X													
31			X															
32								X										
33					X													
34					X													
35					X													
36					X													
37					X													
38					X					X								
39					X													
40								X										
41												X						
42					X													
43					X													
44																X		
45					X							X						
46																	X	
47								X										
48								X										
49																	X	
50					X													
51					X					X								
52								X										

SUMMARY OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

Devil's Run Creek (Upper Section)-continued

Structure Number	Structure Type																	
	BP	BPB	TB	BD	WT_{45}	WT_{90}	WTC	WTB	LS	LS_{45}	L	L_{45}	LWU	LWD	LBP	LJ	DL_{45}	RW
53																	X	
54					X					X								
55					X													
56					X					X								
57					X													
58						X												
59								X										
60								X										
61					X					X								
62								X										
63					X					X								
64					X													
65					X													
66					X													
67								X										
68				X														
69					X													
70					X													
71					X													
72	X																	
73					X													
74					X			X										
75					X													
76	X																	
77					X													
78								X		X								
79					X						X							
80					X													
81								X										
82								X										
83		X																
84						X												
85					X													
86										X								
87					X			X										
88							X		X									
89						X												
90								X		X								
91					X													
92							X			X								
93							X			X								
94							X			X								
TOTALS	3	1	1	4	38	3	10	20	1	14	1	6				6	5		= 1

Devil's Run Structure Totals By Type (Upper and Lower Sections)

	Structure Type																	
	BP	BPB	TB	BD	WT_{45}	WT_{90}	WTC	WTB	LS	LS_{45}	L	L_{45}	LWU	LWD	LBP	LJ	DL_{45}	RW
TOTALS	8	3	2	3	42	5	10	24	2	18	5	9	1	1	1	6	5	1	=

SUMMARY OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

Chesnimnus Creek (Section E)

Structure Number	BP	BPB	TB	BD	WT_{45}	WT_{90}	WTC	WTB	LS	LS_{45}	L	L_{45}	LWU	LWD	LBP	LJ	DL_{45}	RW
1				X			X											
2				X														
3													X					
4													X					
5	X				X													
6						X												
7				X														
8				X														
9					X													
10				X														
11					X													
12				X			X											
13											X							
14					X							X						
15		X			X													
16					X													
17								X										
18					X													
19				X														
20					X													
21						X												
22										X								
23										X								
24			X															
25								X										
26								X										
27					X													
28			X															
29								X										
30					X													
31															X			
32															X		X	
33					X													
34								X										
35								X										
36						X												
37									X									
38					X													
39																	X	
40							X											
41										X								
44								X										
45													X					
46				X	X													
47				X	X													
48					X		X											
49		X			X			X										
50																		POC
51					X													
52					X													
53																		POC
54						X		X										
55								X										

SUMMARY OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

Chesnimnus Creek (Section E) - continued

Structure Number	BP	BPB	TB	BD	WT_{45}	WT_{90}	WTC	WTB	LS	LS_{45}	L	L_{45}	LWU	LWD	LBP	LJ	DL_{45}	RW	
56						X													
57						X													PO
58																X			
59						X													
60							X												
61							X												
62																			FE
63																			GA
64	X				X						X					X			
65	X					X										X			
66						X													
67						X					X								
68	X		X																
69					X														
70	X																		
71								X											
72							X					X							
73					X		X												
74					X		X												
75					X		X												
76							X		X										
77					X		X												
78	X															X			
79					X		X												
80								X											
81																X			
82					X			X		X									
83																	X		
84					X					X									
85				X															
86				X	X		X												POC
87																X			
88							X			X									
89							X										X		
90						X													
91																X			
92					X						X								
93							X	X											
94							X			X							X		
95					X			X											
96					X					X									
97								X								X			
98					X			X											
99							X										X		
100					X		X												
101					X		X		X										
102					X														
103							X			X									
104							X			X									

Chesnimnus Creek (SECTION E) TOTALS BY TYPE

	BP	BPB	TB	BD	WT_{45}	WT_{90}	WTC	WTB	LS	LS_{45}	L	L_{45}	LWU	LWD	LBP	LJ	DL_{45}	RW
TOTALS	7	2	3	11	36	10	24	18	2	10	5	2	2	0	2	12	6	0

APPENDIX VII

DESCRIPTIONS OF IMPROVEMENT STRUCTURES

BY PROJECT STREAM

Devil's Run Creek (Lower Section)

structure Number	Description of Structure
1	18 boulders scattered in creek bottom
2	Log sill keyed into banks, at 45 degrees to channel
3	Log sill keyed into banks, at 45 degrees to channel
4	15 boulders protecting bank along curve
5	Log weir - downstream "vee"
6	Log weir - upstream "vee"
7	6 boulders scattered in creek bottom
8	Log placed diagonally across creek
9	Log placed diagonally across creek, with whole tree at 45 degrees
10	4 boulders instream
11	2 whole trees placed at 45 degrees to channel
12	Log bank protection
13	Whole tree placed at 45 degrees to channel
14	Log sill at 45 degrees to channel, with whole tree bank/cover
15	Whole tree bank protection
16	Log sill keyed into banks
17	Whole tree bank protection
18	Log sill keyed into banks, at 45 degrees to channel
19	Small boulders placed in creek
20	Whole tree placed at 45 degrees to channel
21	Log sill keyed into banks, at 45 degrees to channel
22	Log across creek
23	Log sill keyed into banks, at 45 degrees to channel
24	Log sill keyed into banks, at 45 degrees & boulders placed
25	Whole tree placed at 90 degrees to channel
26	Turning boulders placed
27	Root wad placed on downstream side of eroding bend
28	Boulders placed to protect eroding bank
29	Whole tree placed to protect eroding bank
30	Log placed across creek
31	Whole tree placed at 45 degrees to channel

DESCRIPTIONS OF IMPROVEMENT STRUCTURES

Devil's Run Creek (Upper Section)

Structure Number	Description of Structure
1	2 whole tree placed for cover
2	Whole tree bank protection
3	Log sill keyed into banks, placed at 45 degrees to channel
4	Log sill with whole tree cover
5	Boulder dam with scattered boulders in creek channel
6	Whole tree placed for cover
7	2 whole tress placed at opposing 45's to channel
a	2 digger logs placed at 45 degrees to channel
9	Whole tree bank protection
10	Log sill keyed into banks, placed at 45 degrees to channel
11	3 logs forming a log jam
12	Log jam
13	Boulders placed in and along creek bank
14	2 logs intersecting in creek, 1 being a log sill at 45 degrees
15	Boulder dam
16	Boulder dam
17	Whole tree placed at 45 degrees to channel
18	Whole tree bank protection
19	4 logs forming a log jam
20	2 whole trees cover, 1 whole tree bank protection
21	Log jam
22	Whole tree cover
23	2 whole trees placed at 45 degrees to channel
24	Whole tree bank protection
25	Log sill keyed into banks, placed at 45 degrees to channel
26	10 whole trees forming a log jam
27	Digger log placed at 45 degrees to channel
28	Log sill placed at 45 degrees to channel, with whole tree cover
29	3 whole trees placed at varying degrees to channel
30	Whole tree placed at 45 degrees to channel
31	Turning boulders placed along outside of bend
32	Whole tree bank protection
33	Whole tree placed at 45 degrees to channel
34	2 whole trees placed at opposing 45 degrees to channel
35	Whole tree placed at 45 degrees to channel
36	Whole tree placed at 45 degrees to channel
37	Whole tree placed at 45 degrees to channel
38	Log sill at 45 degrees to channel, 2 whole trees
39	Whole tree placed at 45 degrees to channel
40	Whole tree bank protection, placed along outside bend
41	Log placed at 45 degrees to channel
42	2 whole trees at 45 degrees crossing each other
43	Whole tree placed at 45 degrees to channel
44	4 logs forming a log jam
4.5	Log sill placed at 45 degrees, with whole tree at 45 degrees
46	Digger log placed at 45 degrees to channel
47	3 whole trees placed for bank protection

DESCRIPTIONS OF IMPROVEMENT STRUCTURES

Devil's Run Creek (Upper Section)
(continued)

Structure Number	Description of Structure
48	Whole tree placed along steep cut bank et bend in creek
49	Digger log placed at 45 degrees to channel
50	Whole tree placed et 45 degrees to channel
51	Log sill placed at 45 degrees to channel, with whole tree
52	3 whole trees for bank protection placed along outside bend
53	Digger Log placed at 45 degrees to channel
54	Log sill placed et 45 degrees to channel, with whole tree
55	Whole tree placed et 45 degrees to channel
56	Log sill placed et 45 degrees to channel, with whole tree
57	2 whole trees placed et 45 degrees to channel
58	2 whole trees placed et 90 degrees to channel, & floodplain
59	Whole tree bank protection in outside bend pointed upstream
60	2 whole trees bank protection in outside bend pointed downstream
61	Log sill at 45 degrees to channel, with jackstraw of whole trees
62	2 whole trees, directing flow and bank protection
63	Log sill et 45, 2 whole trees, 1 pointed up & 1 downstream
64	Whole tree at 45 degrees to channel, pointed upstream
65	Whole tree at 45 degrees to channel, pointed downstream
66	2 whole trees at 45 degrees to channel, pointed upstream
67	Whole tree bank protection, pointed upstream
68	Boulder dam
69	Whole tree placed at 45 degrees to channel
70	Whole tree placed et 45 degrees to channel, pointed upstream
71	Whole tree placed at 45 degrees to channel, pointed downstream
72	Boulders scattered in creek
73	Whole tree over floodplain end into creek, to narrow channel
74	3 whole trees, 1 bank protection, 2 et 45's to creek & floodplain
75	Whole tree placed et 45 degrees to channel
76	Boulders scattered along creek
77	Whole tree placed at 45 degrees to channel
78	Log sill at 45 degrees to channel, whole tree for bank protection
79	Log placed mid channel, with whole tree at 45 degrees to channel
80	Whole tree placed at 45 degrees to channel, pointed downstream
81	Whole tree bank protection, placed along steep cutbank
82	Whole tree bank protection, pointed upstream
83	Boulders placed along outside bend in creek
84	Whole tree across creek placed et point of bend
85	Whole tree placed et 45 degrees to channel
86	Log sill keyed into banks, placed at 45 degrees to channel
87	2 whole trees, 1 at 45 degrees to channel, 1 bank protection
88	Log sill, with whole tree cover
a9	2 whole trees across creek, pointed in opposite directions
90	Log sill et 45 degrees, whole tree bank protection,
91	Whole tree placed at 45 degrees to channel
92	Log sill et 45 degrees, with whole tree cover, pointed downstream
93	Log sill et 45 degrees, with whole tree cover, pointed upstream
94	Log sill at 45 degrees, with whole tree cover, pointed upstream

DESCRIPTIONS OF IMPROVEMENT STRUCTURES

Chesnimnus Creek (Section E)

Structure Number	Description of Structure
1	Boulder dam, with 2 whole trees cover, arranged upstream
2	Boulder dam
3	Log weir upstream "vee"
4	Log weir Upstream "vee", with boulder placed at apex
5	2 whole trees, 1 pointed downstream, 145 to channel, boulder
6	2 whole trees arranged side by side across creek
7	Boulder dam
8	Boulder dam
9	Whole tree placed at 45 degrees to channel
10	Boulder dam
11	6 whole trees placed to create a log jam
12	Boulder dam, with whole tree as cover arranged downstream
13	2 logs across creek
14	Log and whole tree forming "X" across creek
15	Boulder bank protection, 2 whole trees at 45 degrees across creek
16	Whole tree placed at 45 degrees to channel
17	Whole tree bank protection
18	2 whole tress placed at 45 degrees to channel
19	Boulder dam
20	2 whole trees placed at 45 degrees to channel
21	Whole tree lining bank
22	2 logs across creek
23	4 log sills placed at 45 degrees, forming a serpentine pattern
24	Turning boulders scattered along creek
25	Whole tree lining bank, arranged downstream
26	Whole tree lining bank, arranged upstream
27	3 whole trees crossing creek at varying 45 degree angles
28	Turning boulders scattered along creek
29	Whole tree bank protection, and providing cover
30	2 whole trees across creek at bends
31	Log lining bank
32	4 digger logs placed at 45 degrees to channel, 1 log lining bank
33	2 whole trees placed at opposite 45's forming "X" over creek
34	Whole tree lining bank, arranged downstream
35	Whole tree bank protection, lining bank arranged upstream
36	Whole tree, across creek and floodplain
37	Log sill keyed into banks placed at 45 degrees to channel
38	Whole tree placed at 45 degrees to channel
39	Digger log placed at 45 degrees to channel
40	Whole tree coyer, laid in creek arranged downstream
41	Log sill keyed into banks, placed at 45 degrees to channel
42	Whole tree placed at 45 degrees to channel
43	Whole tree placed at 45 degrees to channel
44	4 whole trees lining bank, bank protection
45	Log weir, upstream “vee”, connected to #44

DESCRIPTIONS OF IMPROVEMENT STRUCTURES

Chesnimnus Creek (Section E)
(continued)

Structure Number	Description of Structure
46	2 chevron shaped boulder dams, with small tree in floodplain
47	Boulder dam, with whole tree lining bank, arranged downstream
48	2 whole trees, 1 45 degrees to channel, 1 arranged downstream
49	Boulder bank protection, 1 whole tree at 45 & 1 downstream
50	Pool
51	Whole tree placed at 45 degrees to channel
52	2 whole trees placed at 45 degrees to channel
53	Pool
54	2 whole trees, 1 bank protection, 1 across channel
55	Pool with 3 whole trees crossing at varying 45's across creek
56	Whole tree across floodplain and creek
57	Pool with 3 whole trees crossing at varying 45's across creek
58	3 whole trees creating a log jam
59	Whole tree placed at 90 degrees to channel
60	4 whole trees creating a log jam and cover
61	8 whole trees creating a log jam and cover
62	Range fence
63	Water Gap
64	Boulders placed, log sill & 3 whole trees placed at 45 degrees
65	5 whole trees creating log jam, with scattered boulders
66	Whole tree at 90 degrees across floodplain and into creek
67	Whole tree arranged upstream & 2 logs across floodplain and creek
68	Boulders scattered along creek, turning and cover
69	Whole tree placed at 45 degrees to creek
70	3 boulders clusters between #69 and #71
71	2 whole trees along creek bank, arranged upstream
72	Log sill placed at 45, with whole tree across creek & floodplain
73	2 whole trees, 1 across creek, 1 arranged downstream
74	Whole tree at 45 degrees to creek, 2nd tree laid across first
75	3 whole trees, 2 across in opposite directions, 1 downstream
76	2 log sills, with whole tree bank protection arranged downstream
77	2 whole trees crossing creek, 3 whole trees in channel upstream
78	3 whole trees forming log jam with boulder behind it
79	Whole tree across creek, 2nd tree in channel arranged upstream
80	Whole tree bank protection, arranged downstream
81	10 whole tress arranged across creek forming log jam
82	3 log sills at 45's, 2 whole trees across, 1 bank protection
83	Digger log at 45 degrees to channel
84	2 log sills at 45 degrees to channel and 2 whole trees crossing
85	Boulder dam
86	Boulder dam, pool, 4 whole trees, 2 across & 2 downstream
87	Log jam
88	Log sill at 45 degrees, 2 whole trees on top of sill
89	Digger log at 45 degrees, 2 whole trees on top downstream

DESCRIPTIONS OF IMPROVEMENT STRUCTURES

Chesnimnus Creek (Section E)
(continued)

Structure Number	Description of Structure
90	2 whole trees, across creek and up into floodplain
91	6 whole trees in and across creek-forming a log jam
92	Whole tree placed at 45 degrees to creek, and log across creek
93	Whole tree along channel arranged downstream also providing cover
94	Log sill digger log combo., 3 whole trees arranged for cover
95	6 whole trees across creek forming log jam, 2 whole trees BP
96	Log sill at 45 degrees to channel, 4 whole trees across creek
97	3 whole trees bank protection, 6 whole trees forming log jam
98	2 whole trees at 45's criss crossing creek, 2 bank protection
99	Digger log at 45 degrees to channel, 3 whole trees cover
100	2 whole trees, 1 45 to channel, 1 arranged downstream
101	Digger log at 45, 4 whole trees, 3 crossing, 1 downstream
102	2 whole trees placed at 45 degrees to channel
103	Digger log at 45 degrees to channel, 2 whole trees cover
104	Log sill at 45 degrees to channel, 3 whole trees upstream

APPENDIX VIII

JOSEPH CREEK SUBBASIN PROJECT STREAMS

BEFORE AND AFTER RIPARIAN PLANTING PHOTOS

ELK CREEK
PEAVINE CREEK

ELK CREEK 1983 PRE-PROJECT IMPLEMENTATION

ELK CREEK 1987 POST-PROJECT IMPLEMENTATION

PEAVINE CREEK 1981 PRE-PROJECT IMPLEMENTATION

PEAVINE CREEK 1987 POST-PROJECT IMPLEMENTATION

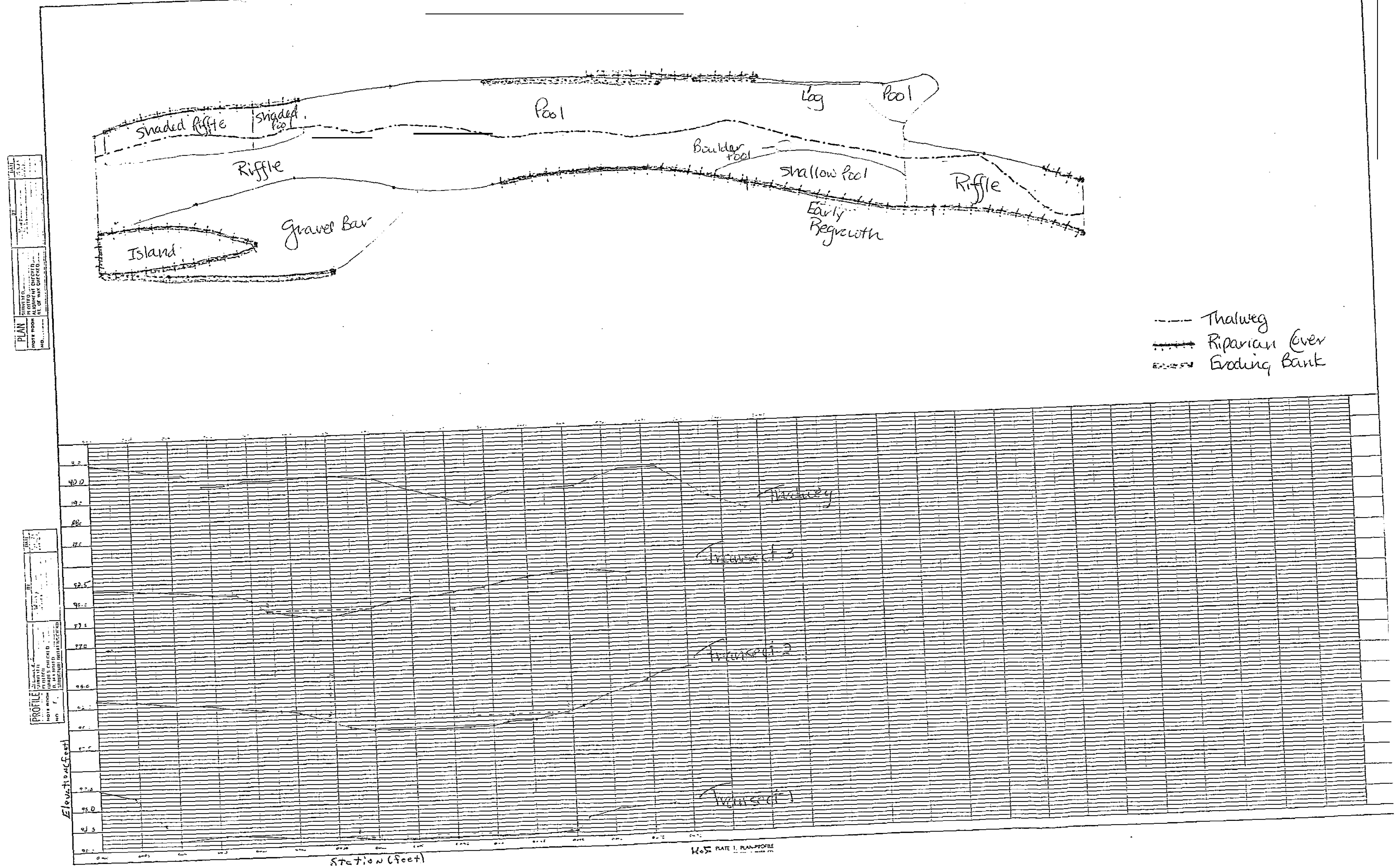
ELK CREEK 1987

ELK CREEK PP 1
1983

PEAVINE CREEK 1987

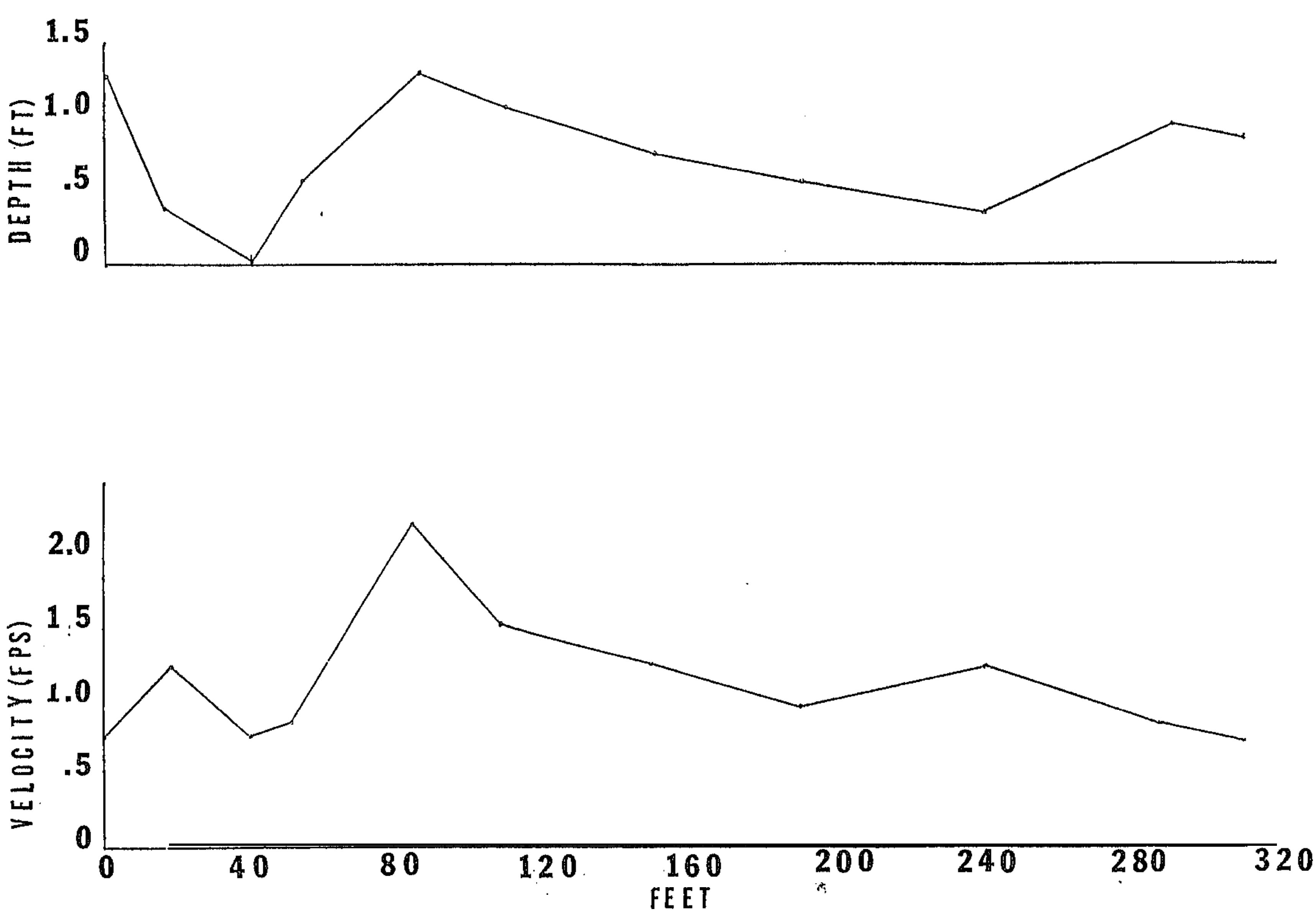
PEAVINE CREEK
1981

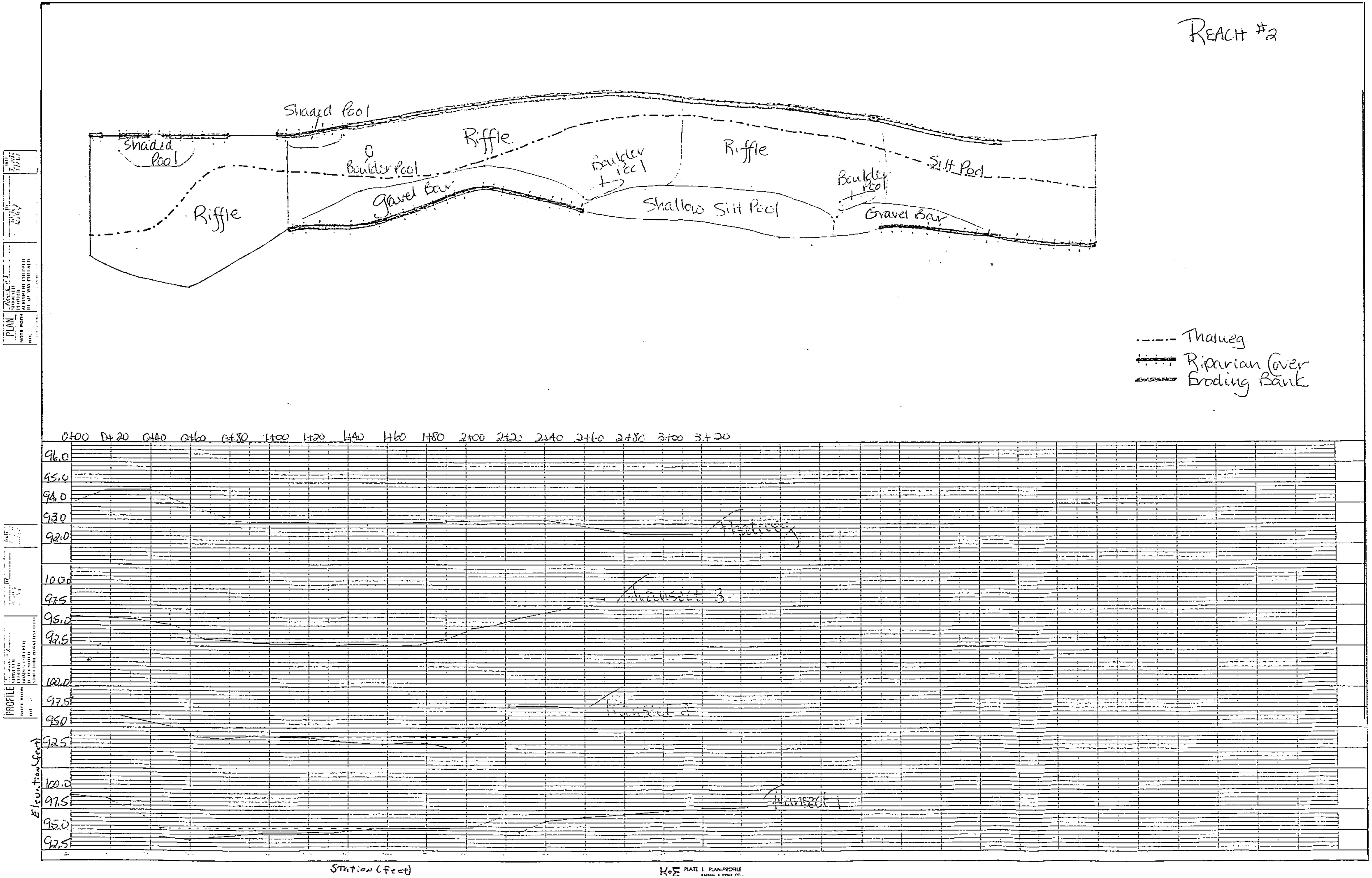
REACH #1



Shaded Riffle
Shaded Pool
Pool
Log
Pool
Boulder Pool
Shallow Pool
Riffle
Riffle
Gravel Bar
Island
Early Regrowth
Thalweg
Riparian Cover
Eroding Bank
PLAN
PROFILE
Thalweg
Transect 3
Transect 2
Transect 1
Elevation (feet)
Station (feet)
PLATE 1. PLAN-PROFILE

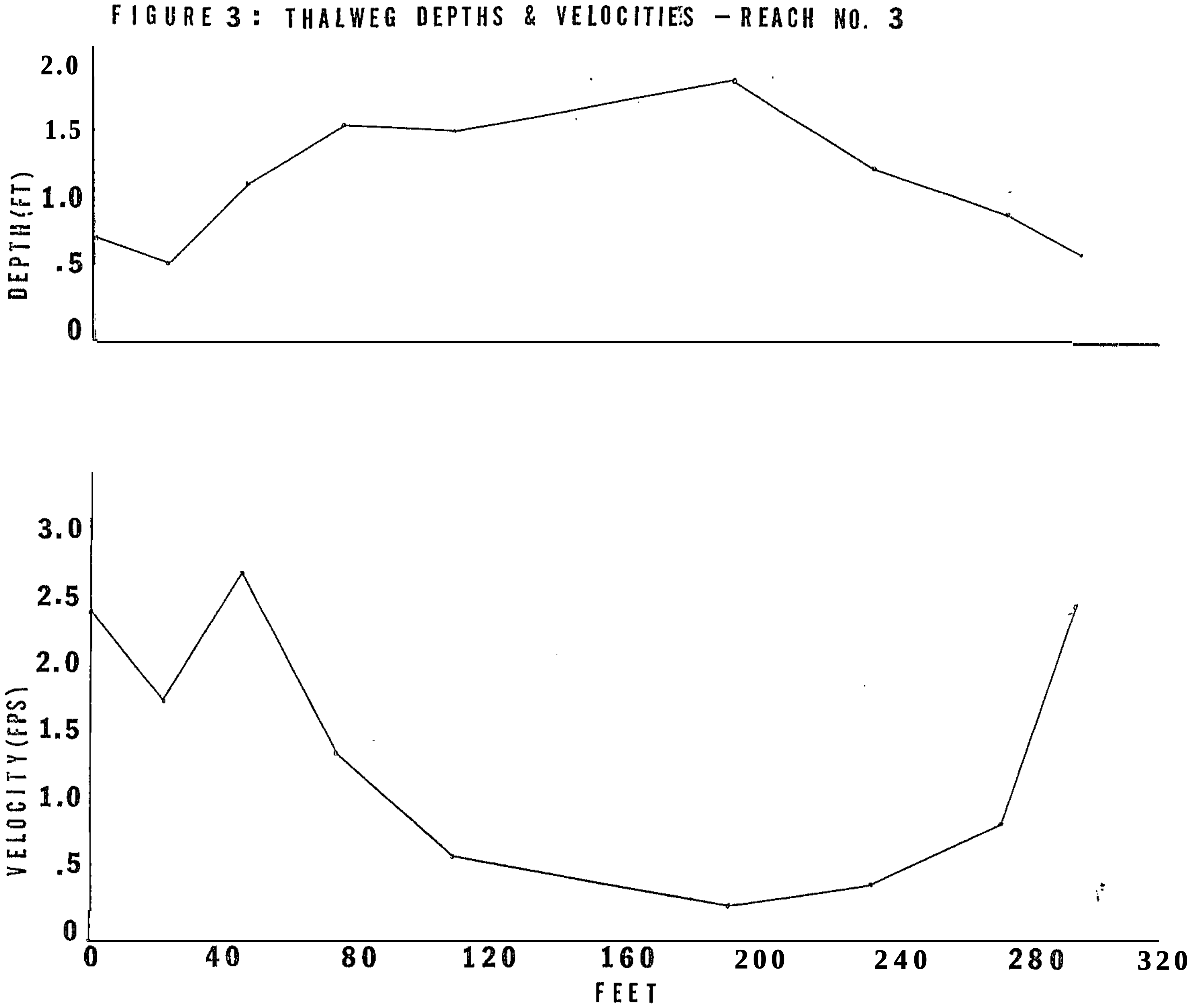
FIGURE 2: THALWEG DEPTHS & VELOCITIES - REACH NO. 2

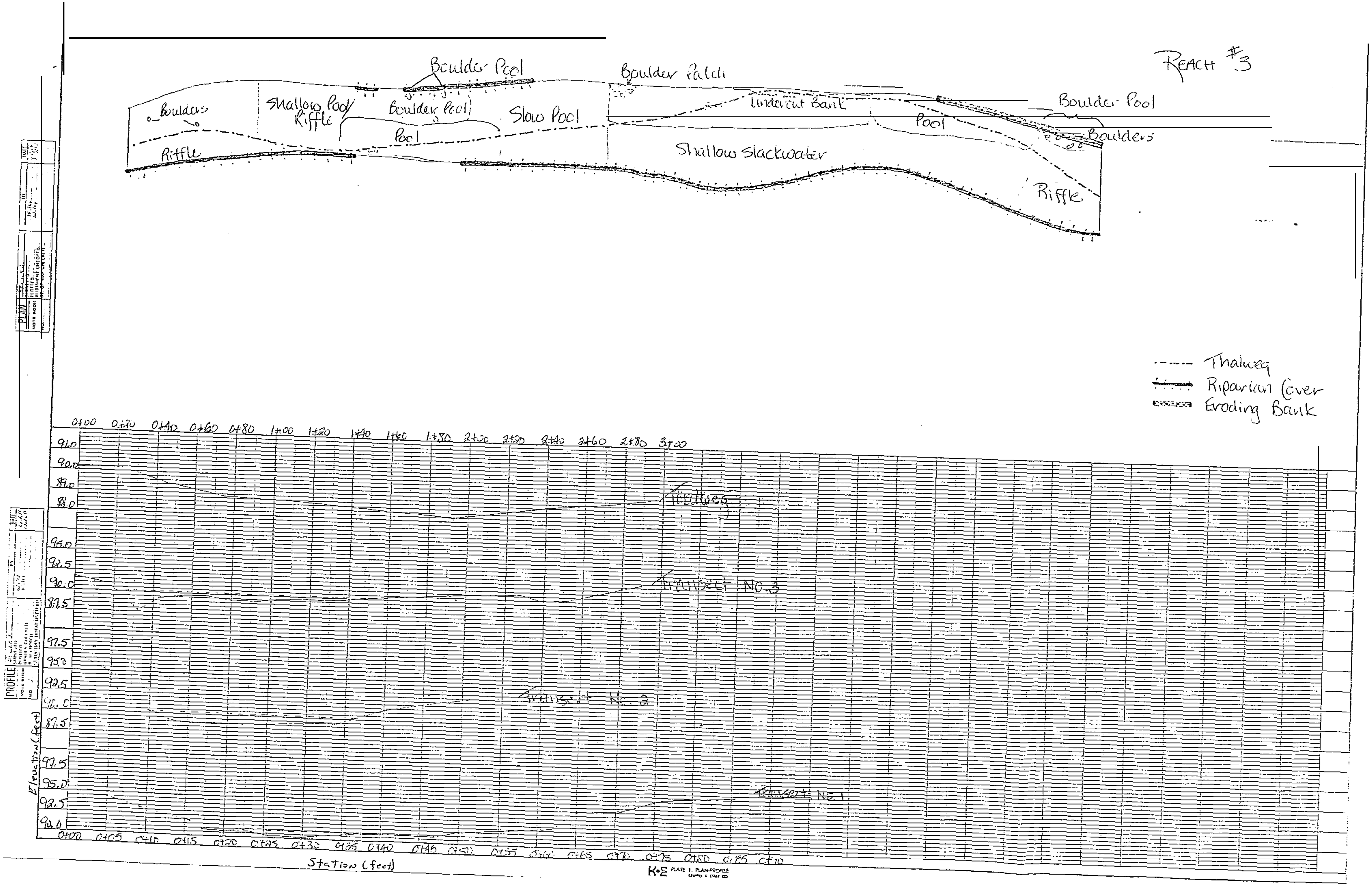




REACH #2
Shaded Pool
Shaded Pool
Riffle
Boulder Pool
Riffle
Gravel Bar
Boulder Pool
Shallow Silt Pool
Riffle
Boulder Pool
Gravel Bar
Silt Pool
Riffle
Thalweg
Riparian Cover
Eroding Bank
PLAN
PROFILE
0+00
0+20
0+40
0+60
0+80
1+00
1+20
1+40
1+60
1+80
2+00
2+20
2+40
2+60
2+80
3+00
3+20
96.0
95.0
94.0
93.0
92.0
Thalweg
100.0
97.5
95.0
92.5
Transect 3
100.0
97.5
95.0
92.5
Transect 2
100.0
97.5
95.0
92.5
Transect 1
Elevation (feet)
Station (feet)
K+E PLATE 1. PLAN-PROFILE

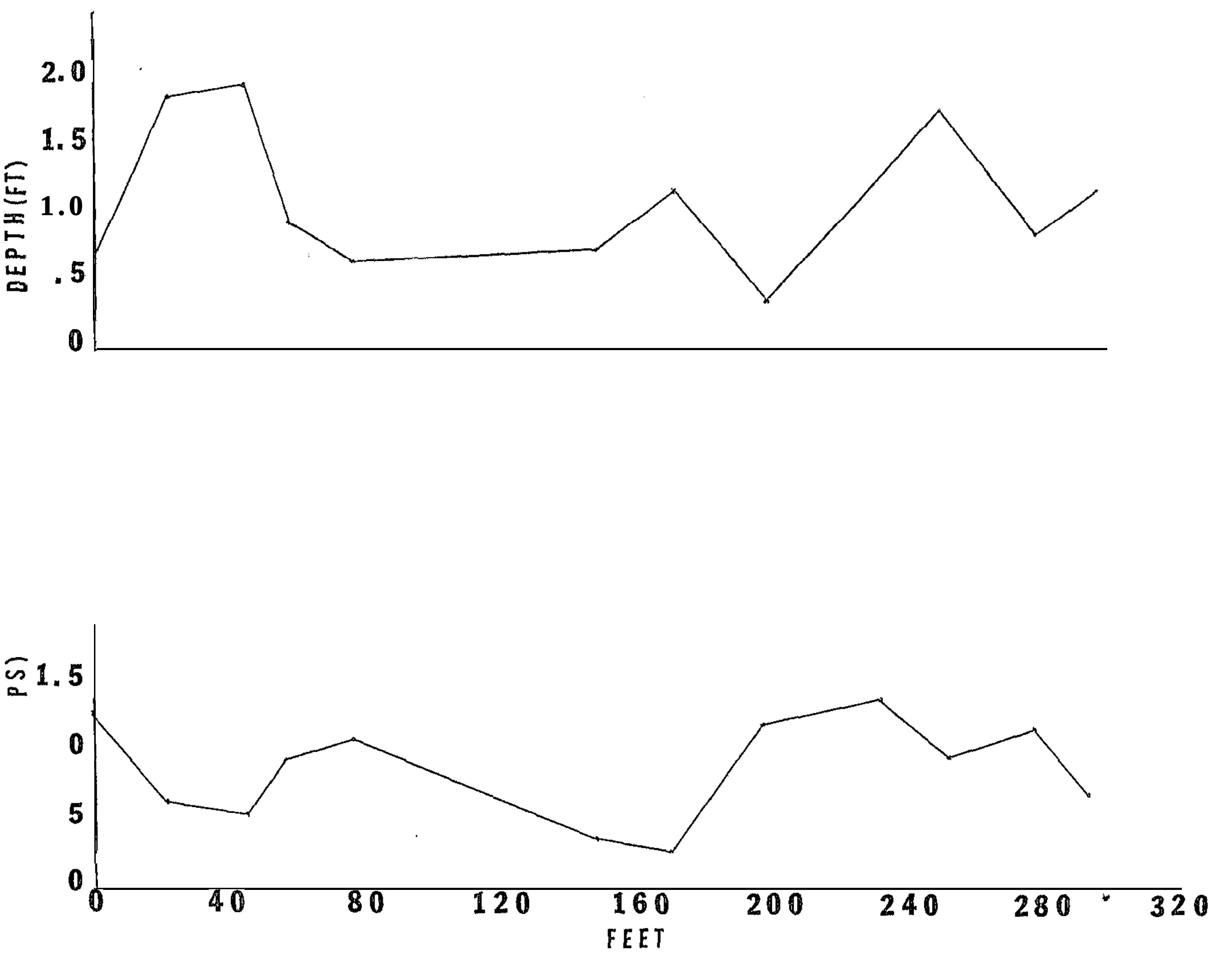
FIGURE 3: THALWEG DEPTHS & VELOCITIES - REACH NO. 3





REACH #3
Boulder Pool
Boulder Patch
Boulders
Shallow Pool/ Riffle
Boulder Pool
Slow Pool
Undercut Bank
Pool
Boulder Pool
Boulders
Riffle
Pool
Shallow Slackwater
Riffle
Thalweg
Riparian Cover
Eroding Bank
Thalweg
Transect No.3
Transect No. 2
Transect No. 1
Elevation (feet)
Station (feet)
PLAN
PROFILE
K+E PLATE 1. PLAN-PROFILE

FIGURE 4: THALWEG DEPTHS & VELOCITIES -REACH NO. 4



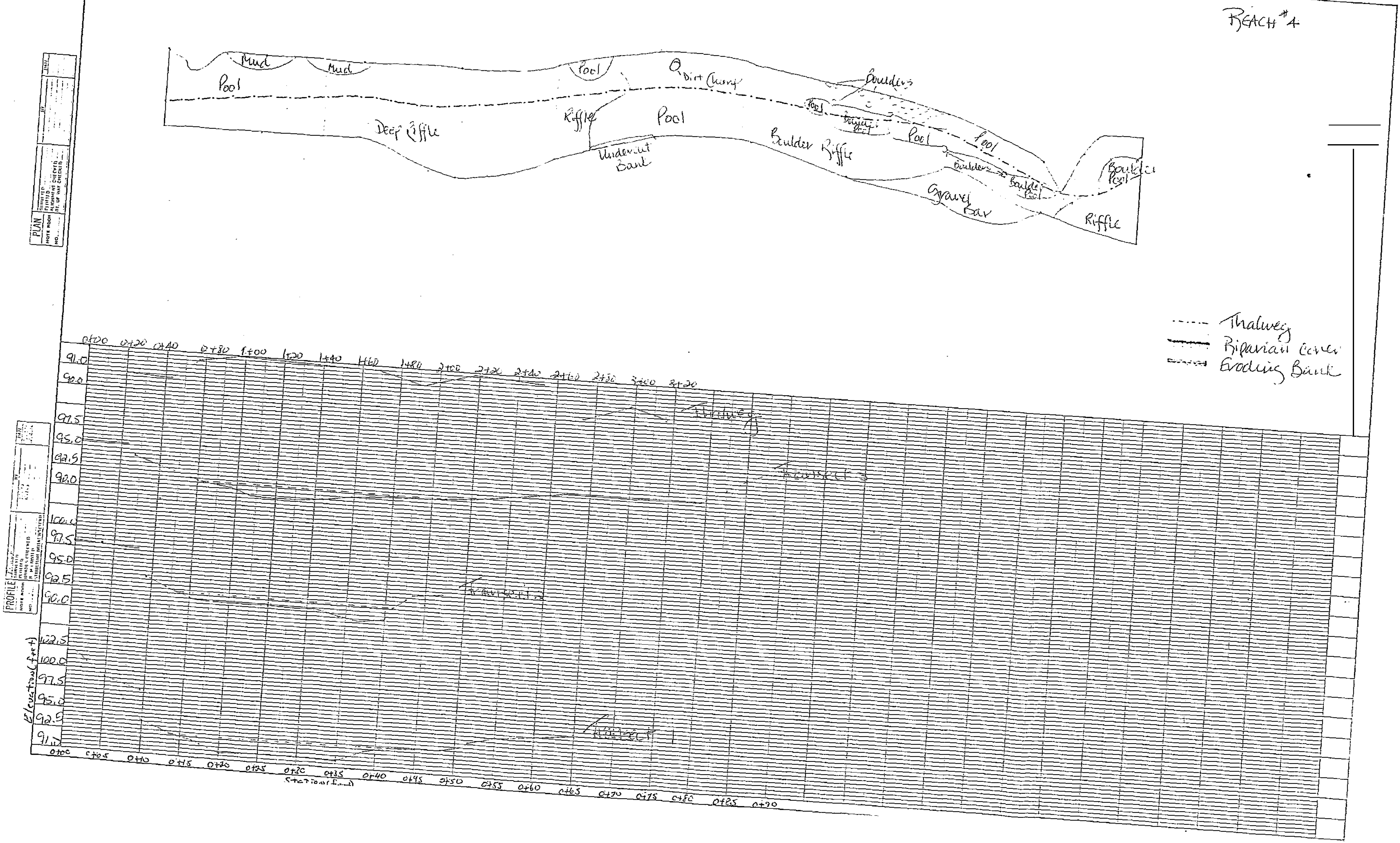
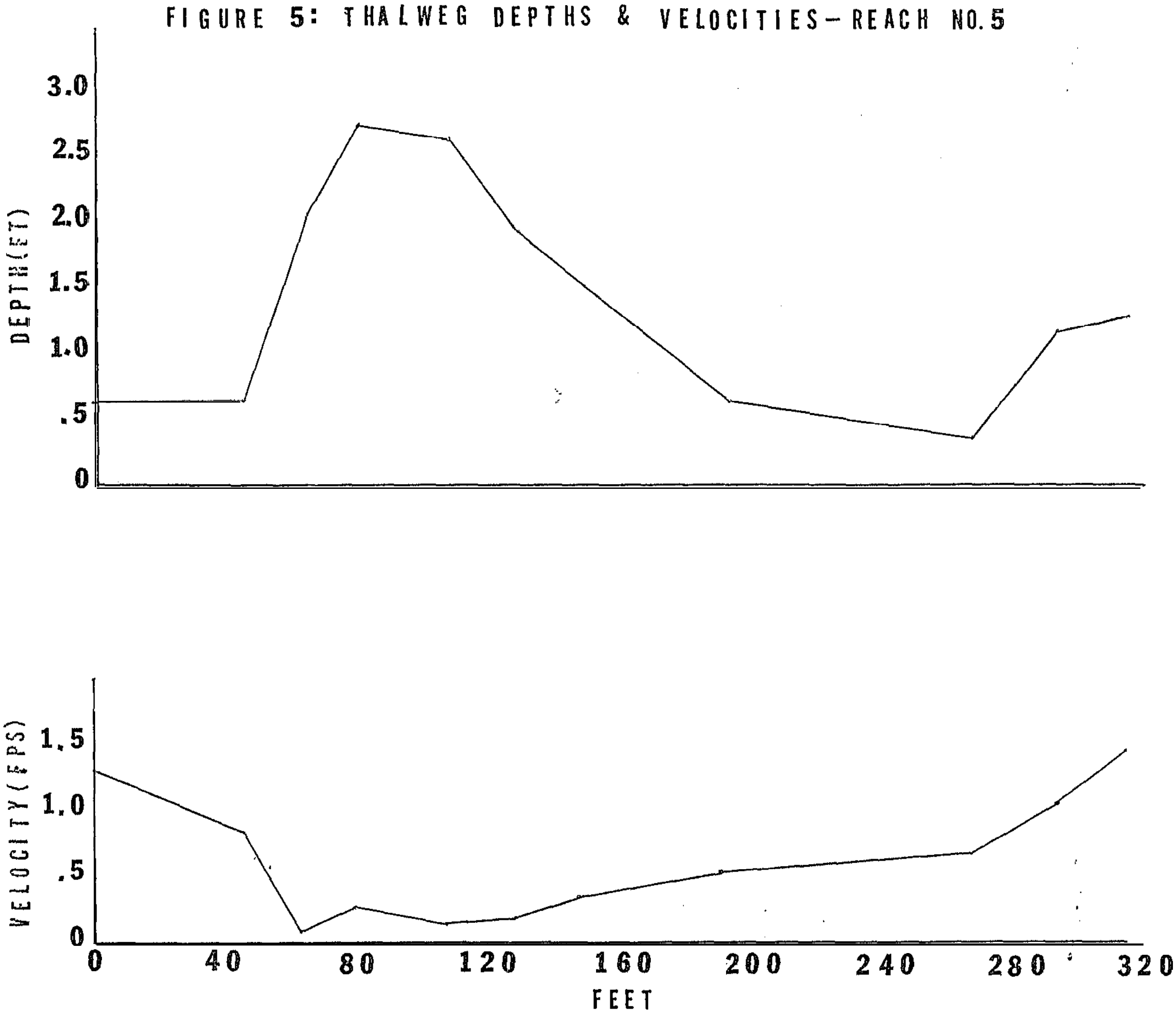

REACH #4
PLAN
Mud
Mud
Pool
Pool
Dirt Clump
Boulders
Riffle
Pool
Deep Riffle
Undercut Bank
Boulder Riffle
Pool
Pool
Boulders
Gravel Bar
Riffle
Thalweg
Riparian Cover
Eroding Bank
PROFILE
Thalweg
Transect 3
Transect 2
Transect 1
Elevation (feet)
Station (feet)

FIGURE 5: THALWEG DEPTHS & VELOCITIES—REACH NO.5



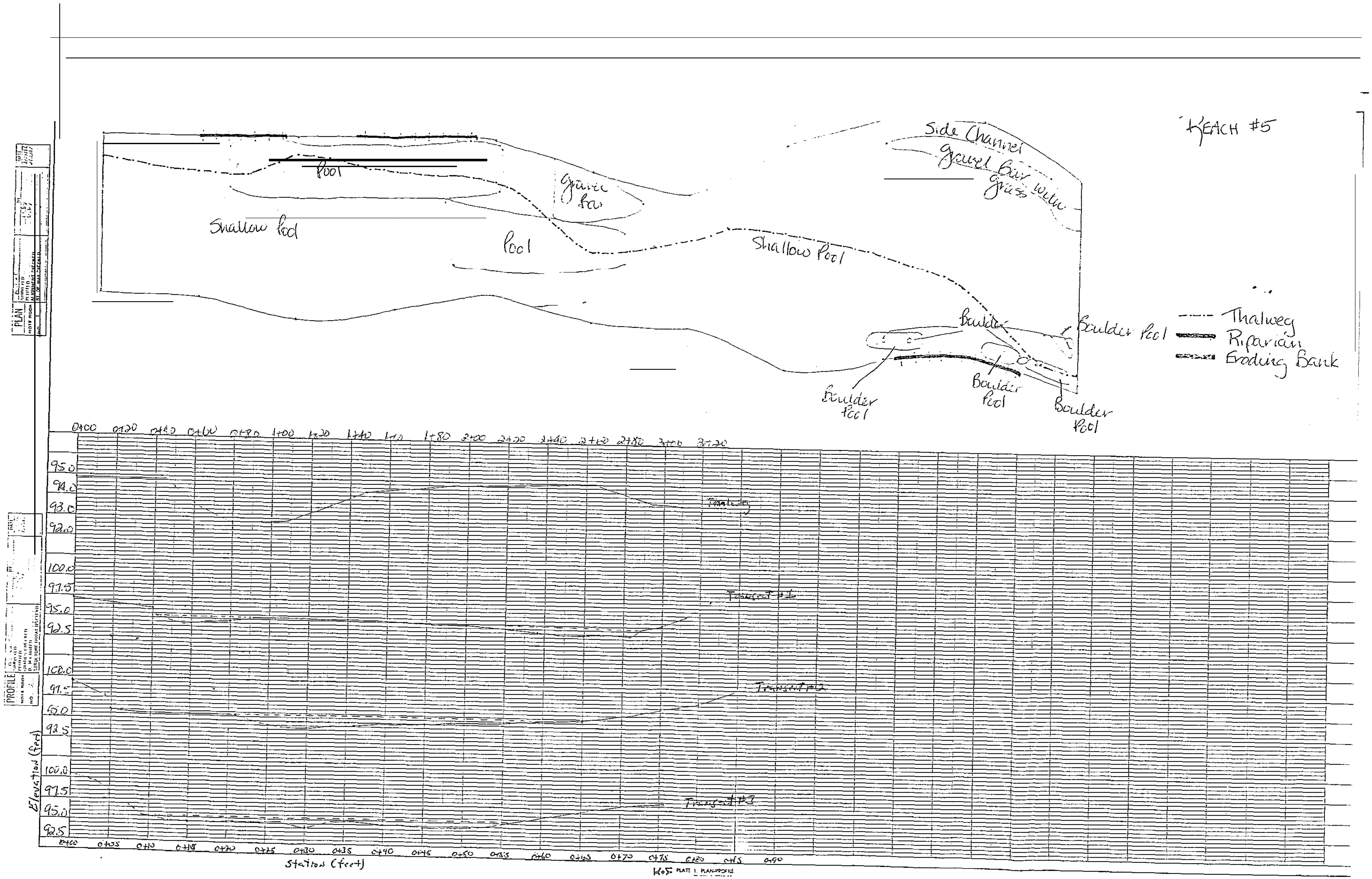


PLATE 1. PLAN-PROFILE